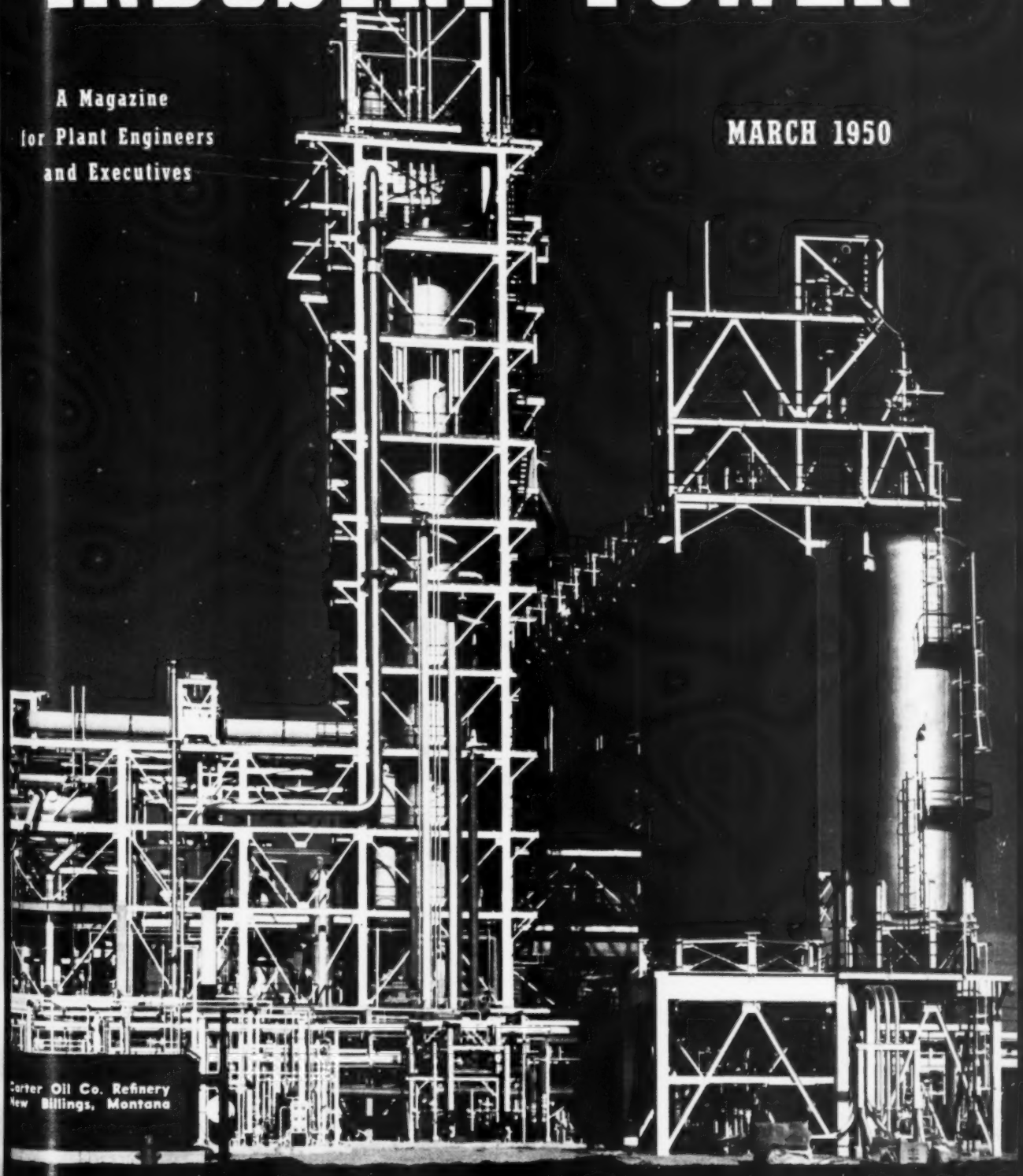
INDUSTRY AND POWER

A Magazine
for Plant Engineers
and Executives

MARCH 1950



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A Magazine for Plant Engineers and Executives

VOLUME 58 — **MARCH, 1950** — NUMBER 3

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Cover Illustration

This fluid catalytic cracking unit, which is designed to process 10,000 bbl of mixed light and heavy gas-oil per day for the production of high-octane gasoline blending stock and No. 2 fuel oil, was the first to operate in the state of Montana. The unit is part of The Carter Oil Company's new completely integrated refinery at Billings, Montana. The Fluor Corporation, Ltd., designers, engineers, and constructors for the petroleum, chemical, and power industries, performed the mechanical design and construction of the entire refinery.

Here is the biggest news in the tool industry today. The leading hand service tools are now named PROTO tools — formerly Plomb tools. All PROTO tools are of the very finest quality. That's why they have been the favorites of professionals since 1907. Remember the name — PROTO tools — formerly Plomb tools, when you want the best. Buy the ones you need from your dealer *today.*

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Apropos of—

You can if you think you can

"TIPS From A Thousand Salesmen" by J. C. Aspley is one of those rare books that contains the kind of advice and information which is as good today as it was yesterday.

One of its chapters is entitled "You Can Do Only What You Think You Can Do." It relates the story of a man in Milwaukee by the name of Kropf who for almost a year thought he couldn't walk. So he didn't try to walk. In time people came to talk about him as a cripple, and he thought he was a cripple.

One day a man by the name of Coue told Kropf that there was nothing the matter with him. He told him that he could walk if he wanted to. He told him this several times until Kropf believed it and stood up and walked.

There's another story that belongs to the nursery set and is appropriately entitled "The Little Engine That Could". Its chant, "I think I can — I think I can", is equally as good advice for the parent as it is for the child.

Psychology, which has such an important role in modern medicine, was right at home generations ago in the family doctor's little black bag. It was represented by the pink sugar pills that were made up by the wise old doctor to help his patients think they were as fit as they actually were.

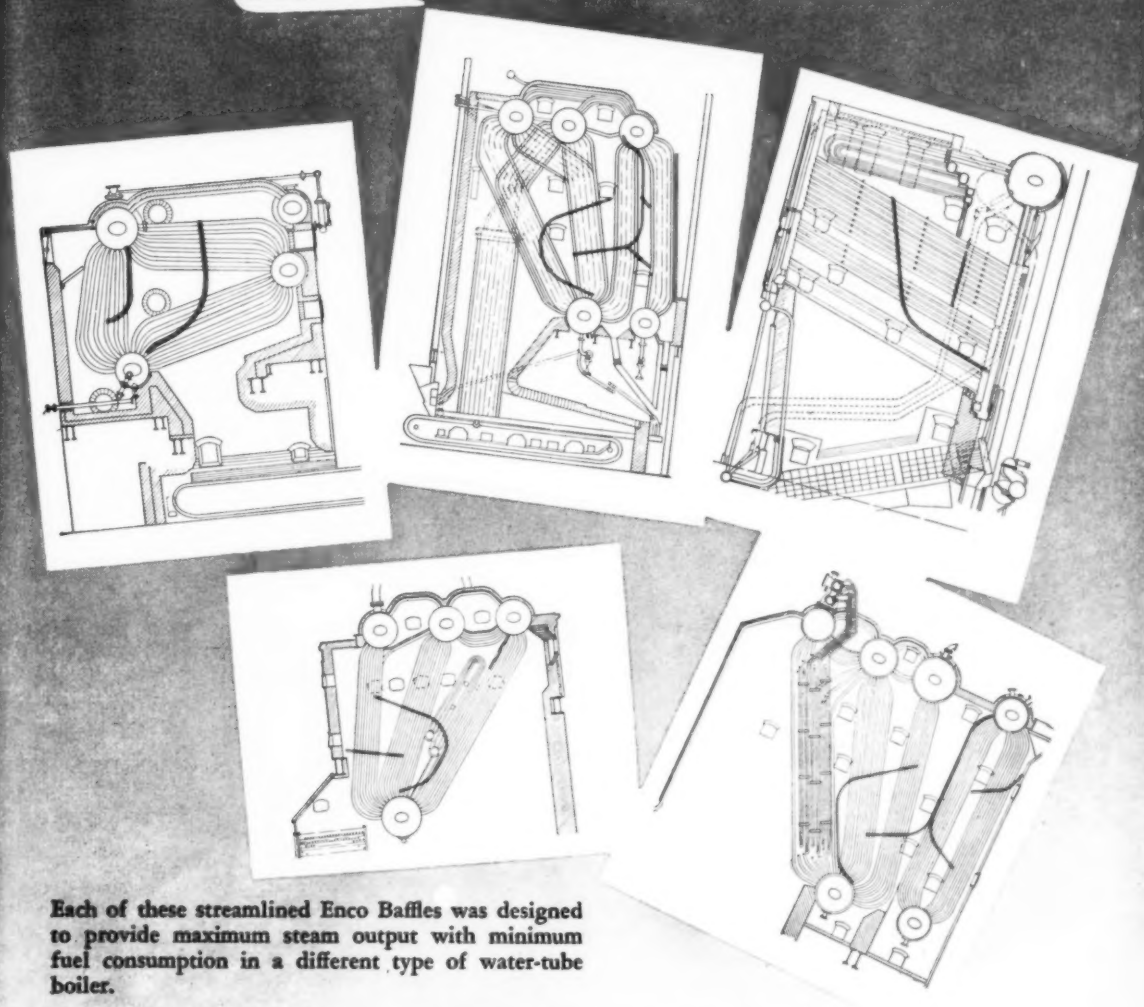
Take a look at any salesman, supervisor, or trouble-shooter whose job is to do what the other fellow thinks cannot be done. What do you find? You find a man who has been cured of the "it can't be done" habit; who feels that anything anyone else can do he can do, and all the king's horses and all the king's men couldn't convince him otherwise.

The kind of confidence which comes from right thinking is nothing new. Neither can its value be underestimated. It's important to you regardless of your place in industry. It's important for your company to have the kind of men who believe in their own abilities and can face a sales curve or a production chart with a calm belief that they can reach any goal set by management.

Our goal, here at INDUSTRY AND POWER, is to publish the most useful and best liked magazine in the industrial field. We'll do it too, because every individual on the staff of INDUSTRY AND POWER believes he can do his part to accomplish that goal — and he can!

M. J. SANDERS
Assistant Publisher

Streamlined for Savings
IN EVERY TYPE OF BOILER



Each of these streamlined Enco Baffles was designed to provide maximum steam output with minimum fuel consumption in a different type of water-tube boiler.

Long sweeping curves maintain a smooth cross flow of gases across every square foot of heating surface. Eddy currents, bottlenecks and dead gas pockets are eliminated—draft losses are cut to a minimum. Soot blowers work more effectively, less steam and less time are needed for cleaning.

Enco Streamline Baffles are individually designed and engineered to the exact requirements of your boiler. Experienced Enco-trained crews take charge of the installation.

The 18-page Enco Bulletin, BW44, shows how engineers throughout industry have gotten higher boiler efficiency and increased steam production through the use of Enco Streamline Baffles. Why not write for your FREE copy today?

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JENKINS PRACTICAL PIPING LAYOUTS 48

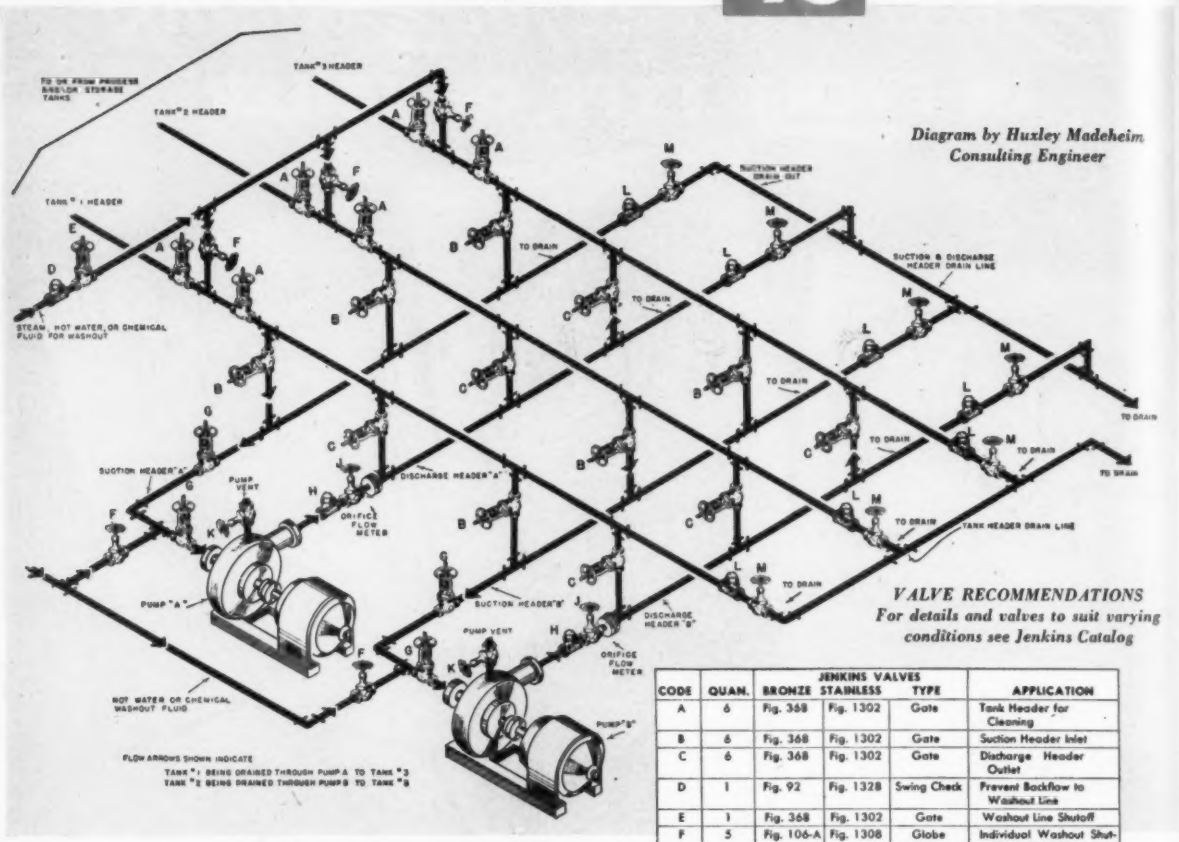
TANK "3 HEADER
TANK "2 HEADER
TANK "1 HEADER
STEAM, HOT WATER OR CHEMICAL FLUID FOR WASHOUT
TO DRAIN
SUCTION & DISCHARGE HEADER DRAIN LINE
SUCTION HEADER "A"
PUMP VENT
ORIFICE FLOW METER
DISCHARGE HEADER "A"
TANK HEADER DRAIN LINE
PUMP "A"
SUCTION HEADER "B"
DISCHARGE HEADER "B"
HOT WATER OR CHEMICAL WASHOUT FLUID
PUMP "B"
FLOW ARROWS SHOWN INDICATE
TANK "1 BEING DRAINED THROUGH PUMP A TO TANK "3
TANK "2 BEING DRAINED THROUGH PUMP B TO TANK "3

Diagram by Huxley Madeheim Consulting Engineer

VALVE RECOMMENDATIONS
For details and valves to suit varying conditions see Jenkins Catalog

CODE	QUAN.	JENKINS VALVES BRONZE	STAINLESS	TYPE	APPLICATION
A	6	Fig. 368	Fig. 1302	Gate	Tank Header for Cleaning
B	6	Fig. 368	Fig. 1302	Gate	Suction Header Inlet
C	6	Fig. 368	Fig. 1302	Gate	Discharge Header Outlet
D	1	Fig. 92	Fig. 1328	Swing Check	Prevent Backflow to Washout Line
E	1	Fig. 368	Fig. 1302	Gate	Washout Line Shutoff
F	5	Fig. 106-A	Fig. 1308	Globe	Individual Washout Shut-offs to Tank Headers
G	4	Fig. 368	Fig. 1302	Gate	Pump Suction Shutoffs
H	2	Fig. 92	Fig. 1328	Swing Check	Prevent Backflow to Pump
J	2	Fig. 106-A	Fig. 1308	Globe	Pump Discharge Control
K	2	Fig. 106-A	Fig. 1308	Globe	Pump Vent Control
L	7	Fig. 92	Fig. 1328	Swing Check	

CENTRAL PUMPING STATION FOR TRANSFER OF FLUIDS

In many industries transfer of fluids within a plant is a major operation. The flexible Pumping Station layout shown allows fluids to be pumped from tank to tank or to any processing equipment.

A single pipe line from each tank or piece of equipment is run to the pumping station and there connected to the suction and discharge headers of each pump. Adequate provision must be made for washing pumps, valves and pipe lines, since pollution of one fluid by the remains of a fluid previously pumped is often harmful.

This may be done by means of steam, hot water or chemical solutions, depending upon the fluids carried. Check valves should be installed on drain lines to prevent destructive backflow into the headers. The valve recommended for this layout is the Fig. 106-A, Jenkins Renewable Composition Disc. Bronze Globe Valve, which assures drop-tight closure.

Consultation with accredited piping engineers and contractors is further recommended when planning any major piping installation.

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NEW EQUIPMENT & DEVELOPMENTS

For Additional Information Concerning These Latest Developments in Power and Plant Equipment, Applications, Materials, Method and Processes Use One of the Convenient Reply Cards on Page 37. Circle the Numbers of Items in Which You Are Interested.

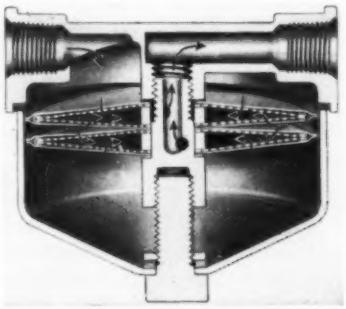
301—PARTS HARDENED BY R-F INDUCTION

Equipment for the continuous, r-f selective induction hardening of cylindrical parts at feed rates to six inches per second, is available from Westinghouse Electric Corporation. The automatic loader, consisting of a magazine and hopper, feeds the pieces to be hardened to the scanner through a feeder unit. The equipment hardens by passing the work through an inductor coil and spray quench ring.

Uniformity of case depth is obtained by controlled feeds; concentricity of case is assured by positive guide and rotation of the cylindrical work piece about its longitudinal axis. This equipment can be used to harden a wide variety of cylindrical parts in any desired hardness pattern by simple adjustment of electronic timing circuits.

302—NEW TYPE FILTER AVAILABLE FOR FUEL OIL AND FLUIDS

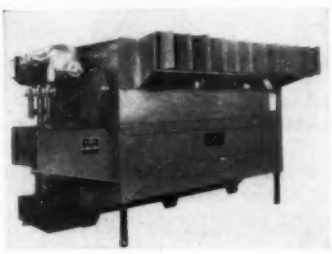
Filter, introduced by the Aparkler Mfg. Co., utilizes a number of features to provide a large effective filtering area within a minimum space. For example, a series of V-shaped horizontal filter discs are bolted into the cover of the filter housing. These discs are easily removed for cleaning or replacing. The filter is recommended for removing solids down to 1 or 2 microns from liquids; for separating water from fuel oils and gasoline; for separating oil from air or water; and for purifying gases. Some of the many uses are



gasoline filters for all types of gasoline engines; fuel oil filters for diesel engines and jet engines; fuel oil filters for domestic and industrial oil burners; air filters for compressors and engines; and air filters for compressed air lines. Housing is high pressure cast aluminum and all contact parts are rust proofed. Sizes and capacities are made to meet every requirement.

303—SPRAY DECK COOLER ADAPTABLE FOR LOW CEILINGS

A new series of spray fan coolers for installation in low ceiling refrigerated rooms has been announced by Niagara Blower Company. The fan section is located on the side of the unit instead of on the top. The air enters the spray section at the top, is chilled, and enters the fan section at the bottom. Discharge is from the side at the top. Temperatures below freezing are kept free from frost, ice, or from freezing by the circulating of brine in the sprays. Five unit sizes are available ranging from 1680 to 11,000 cfm. The maximum height is 72 in. Floor space required ranges from 16 to 72 sq ft. Because of improved efficiency in air travel, experience shows that this new type cooler delivers more air at lower power consumption than do conventional vertically arranged coolers.



304—INSTRUMENT WARNS AGAINST AIR POLLUTION

Industrial plants which discharge gases containing sulfur dioxide can be warned against atmospheric pollution by means of new automatic analyzing equipment. The equipment employs a

thoroughly field-tested principle, and is now available for the first time as a complete assembly manufactured by Leeds & Northrup. This equipment continuously records actual concentration of sulfur dioxide in ppm. The unit automatically checks "zero read-

ing" every thirty minutes, and marks off each cu. ft. of air sampled. Range of the equipment covers the concentration which are of interest in pollution surveys. Changes in concentration as small as a few tenths ppm can be readily detected. The gas-analyzers utilize electrolytic conductivity as a means of measurement. A continuous sample of air passes through a solution which absorbs SO_2, that causes a change in the electrolytic conductivity of the solution.

305—HEAVY DUTY VALVES CAN HANDLE SOLIDS AND CHEMICALS

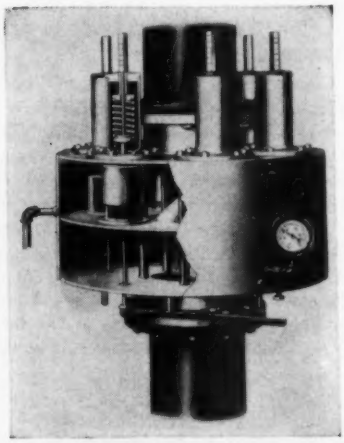
New line of valves has been designed primarily for pipe lines handling such materials as paper pulp, thick or heavy chemicals, slurries, sludges, granular solids, dust and scale, or gases containing a high percentage of solid particles. These new valves provide full flow for line pressures to 100 psi, and may be quickly cleaned of accumu-

lated solids without removal from the line. The cover plate through bolts are removed, and the plate can be swung out of place for dropping the accumulation in the sediment chamber. A high pressure air, steam, or water line attached to the plug hole in the bonnet, will thoroughly clean the entire valve. Cast iron bodies come with a steel blade, and bronze bodies can be supplied with brass or stainless steel blade. The two companion cast valve body sections with removable bonnet are machined with contact faces ground, covered with cement, and then assembled to form an air tight housing. The heavy rigid slide or blade has a knife edge to shear any solid particles when the valve is being closed. The steam moves through a packing gland to the control mechanism. Standardized valve sizes for handle lever control range from 4, to 12 in.; and for rising steam hand wheel control, chain wheel control, and air cylinder control valves range from 4 to 24 in. W. S. Rockwell Co.

For more information use one of the convenient reply cards on page 37. No postage necessary. Circle the key numbers of items about which you want additional information.

306—BACK PRESSURE AND RELIEF VALVES ARE ACCURATE

New back pressure valve, developed by Klipfel Valves, Inc., is made in two types. The new valves are exceptionally accurate and durable and one will maintain steam pressure at any desired point between 0 and 20 psi; while the other is an atmospheric relief valve for vacuum service. Both valves are suitable for heating systems, power plants, and process applications where close regulation of large quantities of steam is required. Valve consists of an inverted cup which slides on a piston cast integral with the valve seat. Steam under pressure enters the chamber between the cup and piston through a restricted opening in the center of the piston. The narrow seating edge of the cup eliminates nearly all the venturi effect of high velocity steam which is the prime cause of poor regulation and chattering. In addition, the restricted opening into the cup chamber makes it an effective dashpot. Welded, all-



steel construction of the valve body provides strength with a minimum of weight; all vertical loads are carried by struts to prevent distortion of any part of the valve. For installations requiring frequent adjustment or water sealing, accessories are available.

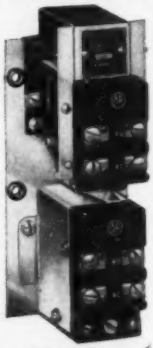
307—CAPACITIES TO 25 TONS SHOWN ON SCALE DIAL

Hydraulic crane scales have been added by Hydroway Scales, Inc. to

their line to provide 8, 12, 24, and 30 in. dia dials in varying capacities now up to 25 tons. The new large 24 and 30 in. dials offer more accurate reading especially in the larger capacities and adapt the scales to specialized applications. Primary use is for weighing stock and materials on the spot without transporting to weighing stations to eliminate handling. Compact design of the scale affords clearance past columns and conserves on hoist capacity and headroom. Secondary application is protection of equipment against overloading.

308—NEW TIME RELAY OPERATES ON D-C OR A-C

New adjustable pneumatic timing relay is now available for a-c or d-c that utilizes a synthetic rubber bellows for controlling the tripping time, according to Allen-Bradley Co. The range is easily adjustable from 10 cycles to 3 minutes, with an accuracy of plus or minus 10%. The relay resets instantaneously. Performance is unaffected by temperature, humidity, or vibration. The timer is available with quick make and quick break, double pole, silver alloy contacts—one set normally open and one set normally closed. Terminals are readily accessible from the front. A duplicate set of contacts for pilot con-



(Continued on page 12)

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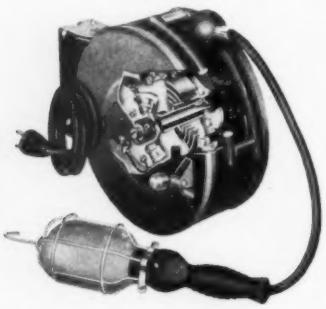
THE *Nalco* SYSTEM • Serving Industry through Practical Applied Science

(Continued from page 10)

trol can also be provided, actuated directly from the solenoid, and opening and closing instantaneously with the action of the solenoid. Unit can be readily changed from "on-delay" to "off-delay" operation by simply inverting the solenoid. The "on-delay" time delay interval occurs after the solenoid coil has been energized; the "off-delay" provides the time delay after the solenoid coil has been de-energized.

309—CORD REEL IS ELECTRICALLY OPERATED

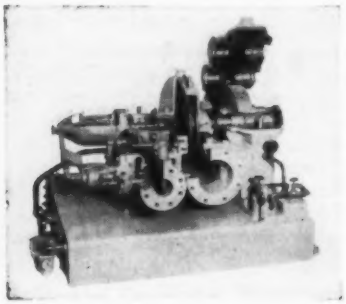
Announcement has been made by Aero-Motive Mfg. Company that an electric cord reel is now available. The



unit is of heavy duty construction with oversize bearings and shaft and has a large and powerful motor spring. One feature of this reel is the external trigger lock and the design used in getting the cable out of the reel. Cable outlet has a long opening which is equipped with a roller at each end and a heavy side beading that apparently offers greatly increased cable life. This reel, equipped with a swivel mounting, reduces cable wear as the unit will swing when cable is pulled sideways. A 30 in. plug-in lead is furnished. Handle and guard are of popular automotive design.

310—GEAR REDUCTION UNIT POWERED BY STEAM TURBINE

Industrial steam turbines with close-coupled, integral reduction gears for

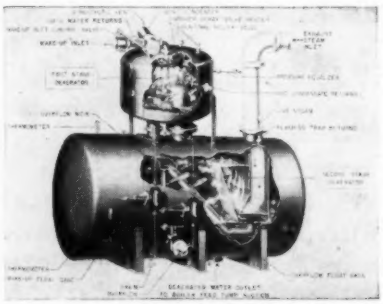


low-speed applications are available from Westinghouse Electric Corporation. Equipment such as pumps, fans, compressors, and generators can be driven at their proper speeds while the turbines operate at the most efficient speed. Units are compact speed reduction mechanism solidly coupled to type E turbines and designed to operate as a single unit. Three machined feet form a firm three-point support for the unit. Single helical gears with low helix angle give low thrust against bearings. Endwise movement of one shaft does not affect axial location of the other, and thrust is not transferred from the gears to the turbine. Turbine and gear are factory aligned on a single, heavy plate steel base, which also serves as an oil tank. Additional steel members maintain rigidity and resist torsional distortion. The gear-turbine is shipped as a completely assembled unit ready to install.

For more information use one of the convenient reply cards on page 37. No postage necessary. Circle the key numbers of items about which you want additional information.

311—TWO STAGE DEAERATING HEATER REDUCES OXYGEN CONTENT

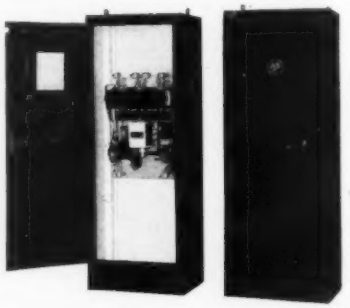
Deaerating heater is now available that reduces oxygen content of boiler feedwater to less than 0.005 ml per



liter measured by the ASTM Referee Method or Modified Winkler test regardless of rapid load variations or unusual operating conditions. Carbon dioxide is completely removed. This new two-stage deaerating heater, developed by Graver Water Conditioning Co., has a special design of spring-loaded, self-adjusting spray valves in the first stage that causes incoming water to heat within 2 to 4° of the steam so as to remove virtually all the oxygen and free CO_2. Preheated water in the second stage is intimately mixed with a large excess of incoming steam by means of specially designed scrubbing baffles. Major portion of the steam, which remains as vapor, carries small traces of undissolved gases to the first stage where the steam heats the incoming water. Countercurrent flow of steam and water accomplishes complete deaeration with minimum steam, and the operation is noiseless and without moving parts inside the heater. Heaters are available in all sizes up to 2,000,000 lb per hour, and the second stage of each heater is tailor-made for individual plant conditions and for the desired storage capacity.

312—TWO NEW UNITS ADDED TO SOLENOID STARTER LINE

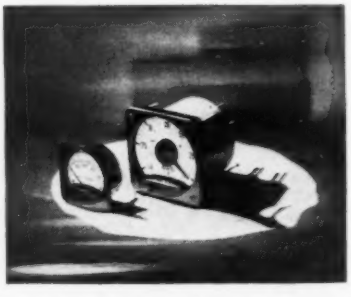
Alternating current, across-the-line solenoid starter made by Allen-Bradley Co. has been extended by the addition



of two new larger units—sizes 6 and 7. The switch construction follows the familiar solenoid design that has been standard for sizes 0 to 5 inclusive. Both units have the one-piece magnetic plunger which operates with a vertical straight line motion. The fully enclosed double break, silver alloy contacts do not require cleaning, filing, or dressing. The solenoids are energized with direct current drawn from a self-contained selenium rectifier. Both starters have adjustable thermal overload relays. All terminals and wiring are accessible from the front.

313—THERMOMETERS INDICATE TEMPERATURES TO 3000° F

Included in a new line of temperature indicators are cold-end compensated thermocouple thermometers for measuring temperatures up to 3000°



F and resistance thermometers for temperatures up to 300° F. The thermocouple thermometer is available

(Continued on page 14)

a beautiful school for Kalamazoo

a fine steam heating plant by **WICKES**

The choice of progressive architects and engineers everywhere, Wickes Package Water Tube Steam Generators will be installed in this completely modern junior high school at Kalamazoo, Michigan. This imposing group of buildings will have a total of 40 classrooms with facilities for 1200 pupils. It is scheduled for completion in 1950 and will take its place as one of the finest junior high schools in the country. Classroom comfort is an important factor in any school, and the three oil fired Wickes Package Water Tube Boilers, equipped with stub stacks and induced draft fans for efficient, economical operation, can be relied upon for an uninterrupted flow of heat every minute of the school day.

Louis C. Kingscott & Associates, Inc.
Architects and Engineers
Kalamazoo, Mich.

C. L. Mahoney
Heating Contractor
Kalamazoo, Mich.

Miller-Davis Co.
General Contractor
Kalamazoo, Mich.

WICKES

THE WICKES BOILER CO.
SAGINAW, MICHIGAN, U.S.A.
DIVISION OF THE WICKES CORPORATION

SALES OFFICES: Atlanta • Boston • Charlotte, N. C. • Chicago • Cincinnati • Denver • Detroit • Fort Worth, Texas • Indianapolis • Jacksonville
Los Angeles • Milwaukee • New York City • Peoria, Ill. • Pittsburgh • Saginaw • San Francisco • San Jose, Calif. • Seattle • St. Louis
Tulsa, Okla. • Mexico City • RECOGNIZED QUALITY SINCE 1854

(Continued from page 12)

in two sizes; the DO-71 a 3½ in. flange and the DW-71 with a 2½ in. flange. Both types can be supplied in either square or round cases. Designed for measurement of low temperatures where high accuracy is important, the resistance thermometers are available in two standard types: the DB-15 long-scale instruments and the DD-6 and DD-7 six inch rectangular, surface and flush mounted instruments. General Electric Co.

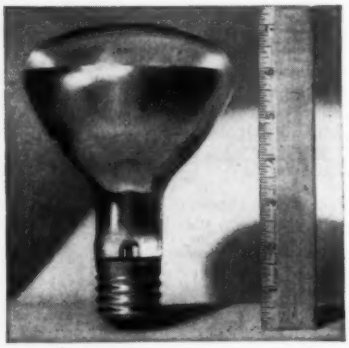
314—VALVE DESIGNED FOR PRESSURES UP TO 150 LB

A new line of 150 lb Hancock bronze valves with "500 Brinell" stainless steel seats and discs and a diaphragm construction has been announced by Manning, Maxwell and

Moore, Inc. The new bronze valves are being manufactured in sizes of ¼ through 2 inches and are available in globe and angle with screwed ends. The valves are designed for all pressures up to 150 psi saturated steam, and to 300 psi for water, oil, or gas.

315—SPOT LIGHT HAS A HARD GLASS SHELL

Announcement has been made of the development of a new 300-watt (five in. diameter face) reflector spot lamp by General Electric Co. The glass bulb and mogul screw base are heat-resistant. The spot distribution of light had been made possible for the first time in a hard-glass reflector lamp by the development of a practical method for lightly frosting the inside of the face of the bulb. Heavy frosting results in a flood pattern, and no frosting at all causes striations to appear in the beam. Intended for outdoor use, the new design will provide a small spot of light that is brighter and has a longer range than can be obtained with the flood lamp. Construction of the lamp makes it desirable for existing and new lighting applications at service stations, garages, parking lots, arenas, industrial plants and yards, roadside stands, street railway yards, bus garages, air-



port hangars and aprons, and docks. The heat-resistant glass bulbs of these lamps withstand the thermal shock of drops of water, oil, and grease much more effectively than do similar lamps without the special glass.

For more information use one of the convenient reply cards on page 37. No postage necessary. Circle the key numbers of items about which you want additional information.

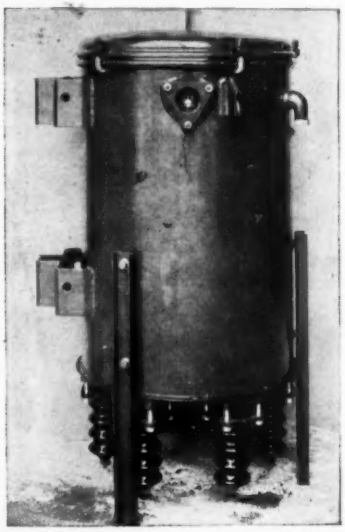
316—NEW CHIPPING HAMMER INCREASES OPERATORS EFFICIENCY

Chipping hammers based on a new design to meet the exacting cutting conditions imposed by present-day metals has been announced by Ingersoll-Rand Company. The hammer has an exceptional performance range and offers a selection of 15 power sizes (with 5 basic hammer sizes) to meet

the requirements of every job. Each basic hammer size is available in normal-cut, extra-cut, or supercut type,—made possible by a design variation in which one part is interchangeable throughout the whole line. The new unit utilizes a new hard-surfacing process that increases piston life 12.3 times. Designed and streamlined for better weight distribution, the comfortable handles enable operators to do their work with greater speed and less effort than formerly possible. Three types of handles are available and all lock in place in a positive manner. Front-end design allows more chisel "play-off", which makes the hammer easy to use and keeps operator fatigue to a minimum.

317—NEW CAPACITOR SWITCH CAN BE USED OUTDOORS

A new capacitor switch, rated 15,000 volts, 100 amperes continuous, 3 phase, has been announced by the Transformer and Allied Product Division of the General Electric Company. The B-1 capacitor switch is oil-immersed, electrically operated, and



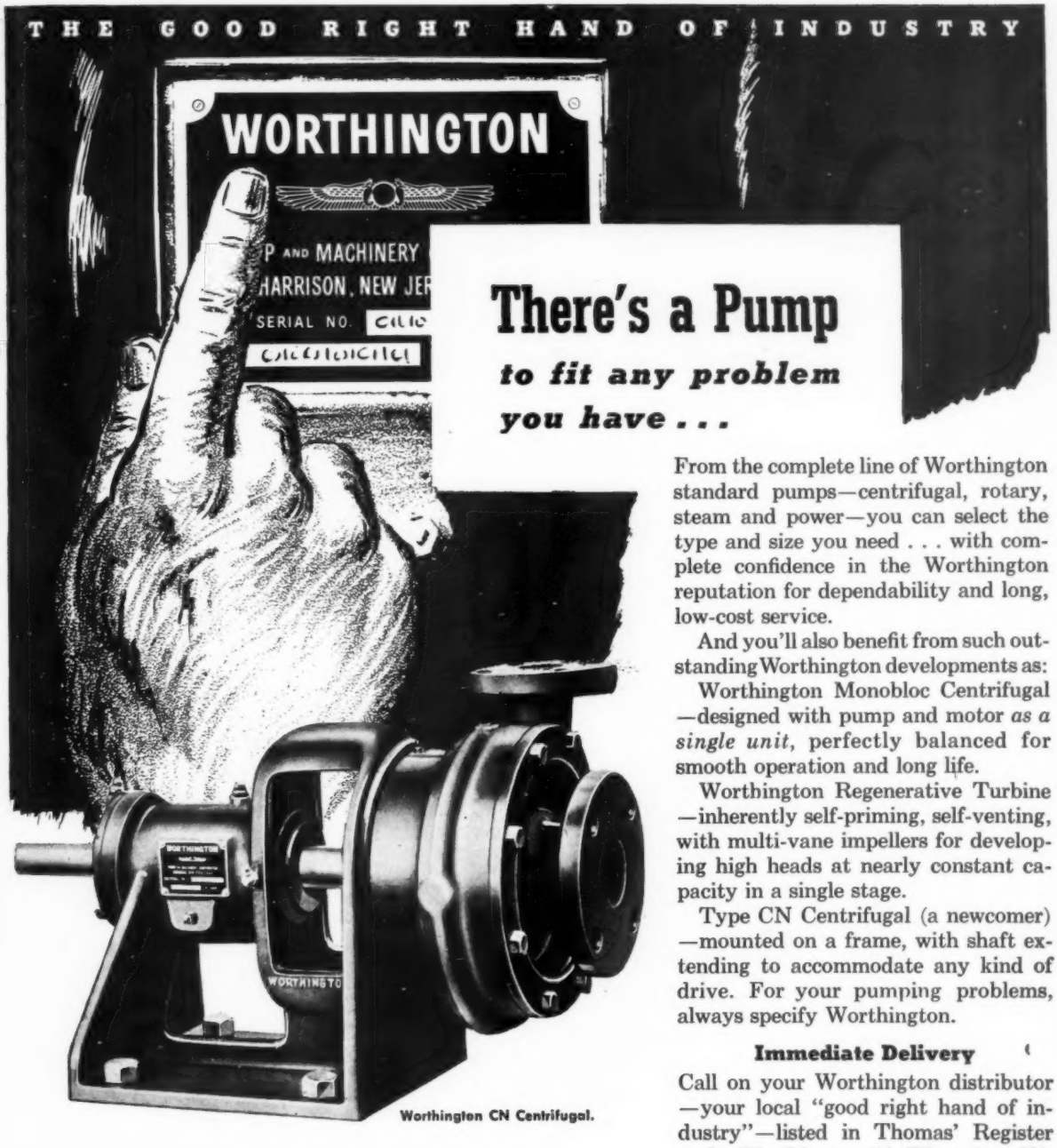
constructed for outdoor installation. Designed especially for capacitors, this switch is intended to encourage capacitor installations on high voltage circuits. Primarily intended for pole mounting, the switch can be supplied as a component part of housed capacitor equipment if desired.

318—TRANSFORMER FOR ELECTRONIC PRECIPATION

Transformers for use as a source of high voltage in equipment for electrostatic precipitation of smoke, metals, or other materials from gaseous mixturers are available from Westinghouse Electric Corporation. The new transformers are oil-insulated and hermetically sealed. Lifting hooks have been recessed into the tank. Low-voltage bushings are in a well with a snap-on aluminum cover, set into the top of the tank and hermetically sealed from

(Continued on page 140)

THE GOOD RIGHT HAND OF INDUSTRY



Worthington CN Centrifugal.

There's a Pump
to fit any problem you have . . .

From the complete line of Worthington standard pumps—centrifugal, rotary, steam and power—you can select the type and size you need . . . with complete confidence in the Worthington reputation for dependability and long, low-cost service.

And you'll also benefit from such outstanding Worthington developments as:

Worthington Monobloc Centrifugal—designed with pump and motor *as a single unit*, perfectly balanced for smooth operation and long life.

Worthington Regenerative Turbine—inherently self-priming, self-venting, with multi-vane impellers for developing high heads at nearly constant capacity in a single stage.

Type CN Centrifugal (a newcomer)—mounted on a frame, with shaft extending to accommodate any kind of drive. For your pumping problems, always specify Worthington.

Immediate Delivery

Call on your Worthington distributor—your local "good right hand of industry"—listed in Thomas' Register under Worthington "A-Z" section. His local stocks are supported by factory stocks for prompt delivery. Send coupon for free bulletin on Standard Pumps.

WORTHINGTON

WORTHINGTON PUMP AND MACHINERY CORPORATION
Pump and Compressor Merchandising Division

The Good Right Hand of Industry

POWER TRANSMISSION: sheaves, V-belts, variable speed drives
PUMPS: centrifugal, power, rotary, steam
AIR COMPRESSORS: water-cooled, air-cooled

PCM98

Worthington Pump and Machinery Corporation
Pump and Compressor Merchandising Division
Harrison, New Jersey

Send latest bulletin on Worthington Monobloc ..... Regenerative Turbine ..... CN .....

Name .....

Company .....

Address .....

NEW BULLETINS

Copies of the listed booklets, which are the very latest published by leading equipment manufacturers, may be obtained by using the convenient postage-free cards on page 37. Circle the letter corresponding to the one shown in the item.

BOILERS, AUXILIARIES, ACCESSORIES

Packaged Boiler (A) Attractive, 12-page, four-color catalog is available that illustrates various sizes of self-contained, oil, and gas fired steam boilers, ranging from a 15 to 500 hp and 15 to 200 psi. Included in the catalog is a diagrammatic cross-section which shows the four pass design incorporated in these boilers. Numerous photographs of actual plant installations are shown. Cleaver-Brooks Co.

Self-contained Boiler (B) Just released bulletin covers a complete line of self-contained steam generators that range in capacity from 20 to 500 hp, at 15 to 200 psi operating pressures. Specifications are included for all units for gas and oil firing, along with conventional outline dimensions. Edge Moor Iron Works, Inc.

Steam Separators (C) Printed in two colors, this bulletin illustrates and covers a complete line of steam separators for 50, 125, and 600 psi operation. Each item is covered individually with specifications and outline dimensions. Selection and ordering data is included. The Swartwout Company.

Air Ejectors (D) Operating principles of steam jet air ejectors are explained and illustrated in a new 12-page catalog. Ejectors are classified as to operating pressures. The theory of inter and after condensers is covered. Useful engineering data is also available. Condenser Service and Engineering Co., Inc.

Soot Blowers (E) Well-illustrated 16 page bulletin just released describes automatic-sequential power-operated soot blowing systems for all types and sizes of boilers. Complete operating procedures are discussed, and ten typical installations are shown diagrammatically. Vulcan Soot Blower Corp.

Bent Tube Boiler (F) Basic design features of this company's bent tube boilers are explained and illustrated in a new 18 page bulletin. Numerous cross-sectional drawings of boilers installed throughout the country are shown along with general operating conditions and specifications. Henry Vogt Machine Co., Inc.

Package Steam Generator (G) Illustrated 12 page bulletin contains data on several designs of packaged steam generating units. Sectional views are shown with outline dimensions and heating surfaces. Performance curves are indicated for oil fired, natural gas fired, and coal fired. Foster Wheeler Corporation.

Vacuum Pumps (H) This company has just released an informative treatise that covers an investigation of rotary vacuum pumps in power house application. Physical and performance characteristics of the pump, operating under actual field conditions, are given. Complete details of the test procedure and result are incorporated. Kinney Manufacturing Company.

PRIME MOVERS: DIESELS, TURBINES, COMPRESSORS

Diesel Quiz (I) Pamphlet describes the features, characteristics, and application of Diesel engines in questionnaire format. The "Quiz" provides simple, easy-to-understand answers to 17 basic questions on design and operation of Diesel engines. Detroit Diesel Engine Div. General Motors Corp.

Battery Maintenance (J) Informative new three-page bulletin, entitled "Instructions for the Maintenance of Gould Batteries for Diesel Engine Cranking Service" presents 14 valuable battery maintenance procedures covering battery care from initial installation through complete charging operations. The first section lists five safety rules, second tells how to install batteries to prevent shifting, while other sections give valuable information on battery cleaning, compartment ventilation, cell identification, and record keeping. The bulletin is punched for easy insertion in a three ring notebook. Gould Storage Battery Corporation.

Stationary Engines (K) Diesel engines are described and numerous installations are illustrated in a new 20-page bulletin. Included are more than 100 specifications for engines ranging in power from the naturally aspirated 6 cylinder, 175 hp engine with 8½ x 10½ in. bore and stroke to a supercharged, 8 cylinder, 1500 hp engine with 14½ x 20 in. bore and stroke. Superior Engine Division of The National Supply Company.

WATER TREATMENT

Chlorine Control (L) Revised handbook edition of Modern pH and Chlorine Control" describes the factors to control pH chlorine and phosphates in boiler waters. The new booklet contains photographs and general instructions for the application of equipment in determining concentration tests. W. A. Taylor and Company.

Chlorine Dispenser (M) New eight-page illustrated catalog describes an improved line of dispensers, that accurately, safely, and automatically meter, control and dispense chlorine. Self-contained cabinet-type units have capacities ranging from a minimum of one lb to a maximum of 1200 lb of chlorine per day. Fischer and Porter Company.

Anti-Precipitating Agents (N) Technical folder describes the use of anti-precipitating agents for the prevention of scale, deposits, and corrosion in cooling systems, service water lines, heat exchangers, and other process equipment. A flow chart of a typical plant cycle is included to show where deposits may occur or where corrosion may take place. Corrective treatments are explained in detail. Power Chemicals Division, E. F. Drew & Co., Inc.

Water Hardness Test (O) Technical paper entitled "Total Hardness in Water by Direct Colorimetric Titration" explains thoroughly a quick and accurate method of testing water hardness by titration with an indicator—which is red in the presence of calcium and magnesium ions, and blue in their absence. Samples can be analyzed to 0.1 ppm in a range of 0.0—2.0 ppm. W. H. & L. D. Betz.

Cold Process Softener (P) Just released 16 page bulletin explains how this cold process slurry type precipitating water softener and coagulator operates. Each of the component parts—chemical mixer, softener and coagulator tank, and filter—are discussed and illustrated. A two-page flow diagram illustrates method of installation sequence. Worthington Pump and Machinery Corporation.

ELECTRICAL EQUIPMENT

Explosion-Proof Motors (Q) Bulletin, expressly for engineering, production, purchasing, and maintenance men, describes and illustrates three classes

(Continued on page 149)

PLANTS THAT PROSPER

...cut powerhouse costs with FAIRFIELD coal and ash handling equipment!

Tile Silo and Elevator at Midwest plant.

Belt Conveyor in Tunnel.

Large capacity Twin Silo System.

Chutes to Stokers from overhead bunker.

Skip Hoist and Cylindrical Bunker.

Tile Ash Bunker and Elevator.

Weigh Larry serving three boilers.

Screw Conveyor feeding stokers.

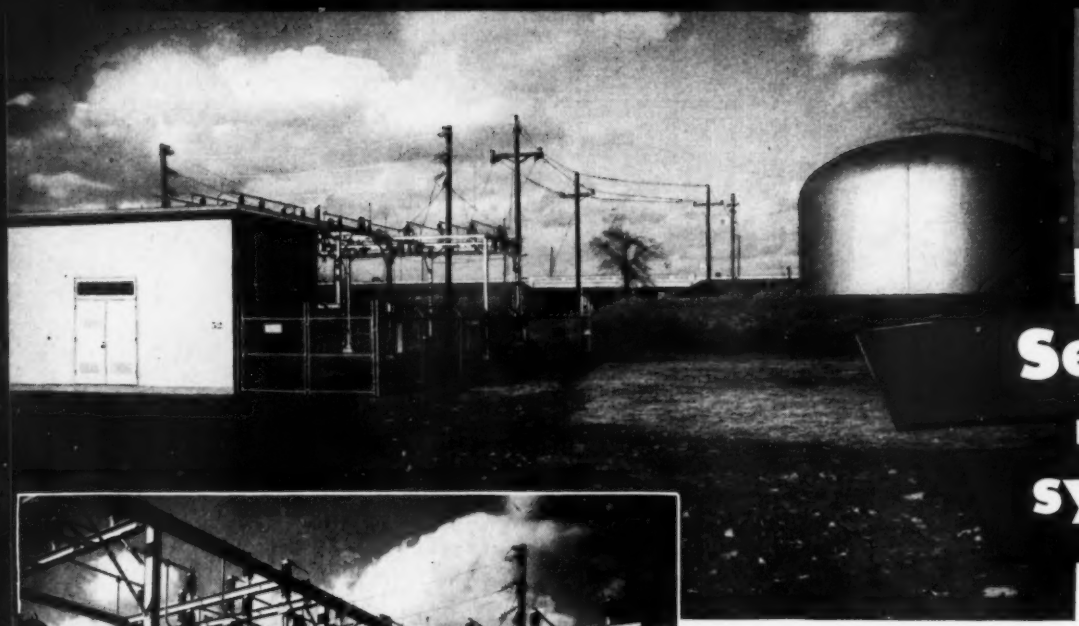
Your powerhouse plays an important part in your production set-up. Keep efficiency at a high level . . . hold costs in line by modernizing your coal and ash handling system.

At no obligation to you, a Fairfield engineer will call and make a recommendation for improving your coal and ash handling operation. Fairfield engineers are thoroughly familiar with coal and ash systems for plants of any capacity. Thousands of installations in all parts of the country stand behind Fairfield's reputation for sound engineering and prompt erection. Write for an appointment with the Fairfield engineer in your area.

THE FAIRFIELD ENGINEERING COMPANY

Builders of Dependable Coal and Ash Handling Equipment

337 CHICAGO AVE. MARION, OHIO



Service co

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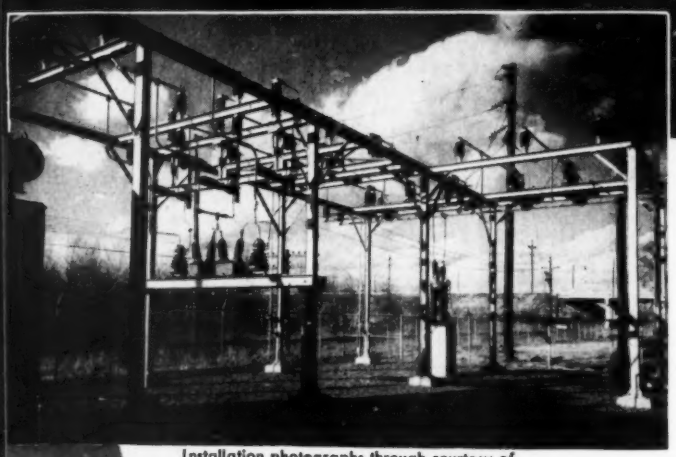
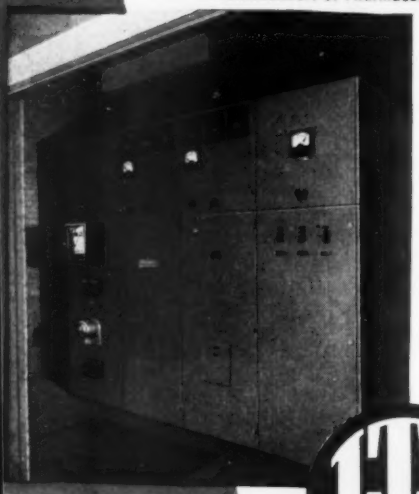


Installation photographs through courtesy of Hoffman La Roche, Inc., Nutley, N. J., Manufacturers of Pharmaceuticals.



4000 KVA substation. Incoming voltage 26.4 KV. Outdoor structure layout prepared by R&IE*. Air break switches are type TTR rated 34.5 KV, 600 amperes.

Indoor switchboard is I-T-E type HV. Breakers are rated 1200 amperes continuous, 4160 volts, 150,000 KVA interrupting.

* An I-T-E subsidiary.

Here's another electrical switching and protection problem solved—economically and positively. The I-T-E switchgear installed provides complete protection from point of power entry to individual feeder circuits.

HERE'S WHY:

• **APPLICATION WAS PLANNED TO FIT A SPECIFIC NEED.** No two distribution systems are absolutely alike. I-T-E sales engineers start with an analysis of *your* system and make recommendations and application based on what is required to provide adequate protection.

• **EQUIPMENT IS EFFECTIVE AND DEPENDABLE.** The design of I-T-E components evolves from over 60 years experience in building electrical switching equipment. The confidence in I-T-E gear results from the performance of equipment installed over that period of time.

• **UNITS ARE PROPERLY COORDINATED** I-T-E furnishes an *engineered* assembly. All breakers, relays, instruments, transformers and switches are functionally

I-T-E

For *more dependable* Switchgear

specify I-T-E

I-T-E Circuit Breaker Company · 19th & Hamilton Streets · Philadelphia 30, Pa.

Power Switching Equipment: Railway & Industrial Engineering Co., Greensburg, Pa.

Canadian Mfg. & Sales: Eastern Power Devices, Ltd., Toronto · Export Sales: Philips Export Corp., New York

SWITCHGEAR • UNIT SUBSTATIONS • ISOLATED PHASE BUS STRUCTURES • CIRCUIT BREAKERS • MECHANICAL RECTIFIERS RESISTORS • SPECIAL PRODUCTS

continuity assured with

protection by I-T-E

arranged and conform to the recognized codes specifying safe and accepted practice.

• **DESIGN FACILITATES INSPECTION AND MAINTENANCE.** Complete and ready accessibility of all parts makes inspection fast and easy. More inspection per allotted hours of time results in better system maintenance.

• **"PACKAGED DELIVERY" SIMPLIFIES INSTALLATION.** I-T-E switchgear is assembled, tested and shipped as a complete unit or series of units. Only positioning and connecting is required in the field.

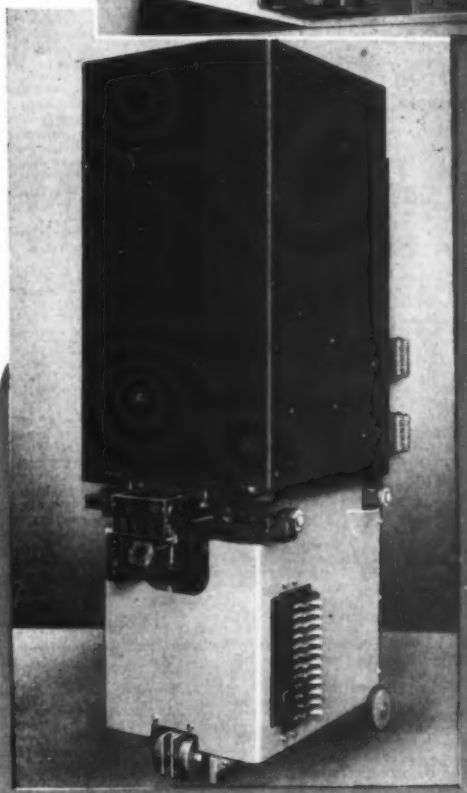
• **FULL RESPONSIBILITY ASSUMED.** I-T-E accepts complete responsibility for the operation and performance of every component furnished on your order. This includes purchased auxiliaries as well as equipment manufactured by I-T-E.

GET THESE HELPFUL BULLETINS

On I-T-E 600 V Switchgear Assemblies: A complete reference guide, containing detailed information on Multumite construction, and helpful facts for specifying and ordering complete switchgear equipments. Ask for Bulletin 6003-D.

On I-T-E 5 KV Assemblies: Describes I-T-E's newest 5 KV Switchgear. Easy-to-read drawings and diagrams supplement photos and text. Ask for Bulletin 7000-A.

Ask your local I-T-E Representative for these bulletins, or write I-T-E General Offices.



CONSTRUCTION OF TYPE HV SWITCHGEAR EMPHASIZES ACCESSIBILITY

Meters and instruments (above) are semi-flush mounted on hinged doors in individual compartments.

They are easily reached for inspection and maintenance.

Circuit breakers of the HV type below are horizontal drawout truck mounted.

No transfer dolly or elevator mechanisms required.

READERS' GUIDE

to equipment advertised and available literature

For your convenience all the literature offered in the advertising of this issue is briefly reviewed in this guide. If you are interested in a particular type of equipment, such as electrical for example, refer to the section "Electrical Equipment", read the advertisements, and select the literature you want. Circle the corresponding numbers on one of the postage-free cards on page 37 and mail. You will receive promptly the additional information you desire.

BOILER & FURNACE CONSTRUCTION UNITS

1—See page 56. Steam-Pak Generator: Efficiency originates with the Iris Shutter that controls the air injected into the burner for proper flame control with either gas or oil. Ask for Bulletin 37-43. York-Shipley, Inc.

2—See page 137. Firebox Type Boilers: Especially adapted for high pressure 10 to 304 hp, 100, 125, 150 hp wp. Send for full information and free 6 in. scale with pipe diameter markings. Kewanee Boiler Corp.

3—See page 129. Steam Generator: Write for more data on the Union "H" Type steam generator—steel cased boiler with superheater, dust collector, air heater, ducts, fans, and stacks out-of-doors. Union Iron Works.

4—See page 7. Boiler Baffle Walls: Bulletin BW-44, 18-pages containing valuable useful data on modern Baffle Wall design and construction for all water tube boilers. The Engineer Company.

5—See page 13. Package Water Tube Boilers: Selected by progressive architects and engineers everywhere for efficient, economical operation. Wickes Package Water Tube Boilers, equipped with stub stacks and induced draft fans, can be relied upon for uninterrupted flow of heat. Complete information is yours for the asking. The Wickes Boiler Co.

6—See page 41. Cleaver-Brooks Steam Boiler: Write for your copy of the new, just published Cleaver-Brooks steam boiler catalog—interesting—informative—beautifully illustrated. No obligation. Cleaver-Brooks Company.

7—See page 133. Heacon Damper: Built to meet all types of applications. However, they are proved outstanding through their solution of difficult control or shut-off problems. Write for more information or ask for specialized engineering assistance without obligation. The Thermix Corporation.

8—See page 28. Steam Generating Units: A bulletin showing typical installations of this firm's Class VL units or power or processing loads, and heating will be sent upon request. Henry Vogt Machine Co.

9—See page 2. Packaged Steam Generators: Send for fully illustrated Catalog 202 that gives complete details and engineering data for units available in 17 sizes from 20 to 500-bhp to operate at pressures up to 250 psi 80% thermal efficiency guaranteed. Superior Combustion Industries, Inc.

10—See page 116. Cost-Saving Steam Generators: Powermaster is a completely equipped steam plant, available in sizes from 15 hp up. You can burn light oil, heavy oil, gas or a combination of these three fuels. Wired, piped, insulated and tested at the factory. Get complete information by sending for the new Powermaster Catalog. Orr & Sembower, Inc.

BOILER FEED WATER

11—See page 136. Oxygen Corrosion Eliminator: Santosite, maintained in boiler feed water, removes dissolved oxygen and prevents oxygen corrosion. Send for Santosite Bulletin No. 0-26. Organic Chemicals Div., Monsanto Chemical Co.

12—See page 11. Water Treatment Security: Check into the advantages that can be yours through the Nalco Service Agreement—complete water treatment survey, supervision of control and testing procedures, plus regular service calls. Your water treatment becomes the responsibility of Nalco. Write for full details. National Aluminate Corp.

13—See page 140. Water Conditioning Chemicals: Easy to control scale and corrosion in boilers, steam and condensate lines, water jackets, condensers. Send for bulletin giving full information on Wright Chemicals and their application. Wright Chemical Corp.

14—See page 162. Scale and Corrosion Control: 16 fluid ounces protect a 250 hp-boiler for a whole month. Tops in economy, convenience, certainty and safety. Write today for complete information. American Sand-Banum Company, Inc.

15—See page 155. Chlorinators: Reduce down time, cut operating costs, improve heat transfer with the Visible Vacuum Chlorinator for the application of chlorine to cooling water circuits through the W & T De-sliming process. For complete information, write today. Wallace & Tiernan Products, Inc.

16—See page 123. Scale, Corrosion and Algae Control: Write for special literature on film inhibitors in industrial aqueous systems. D. W. Haering & Co., Inc.

17—See page 30. Inquiries Welcomed: Publication 4160, "Cochrane Atomizing Deaerators", is a clear, unbiased discussion of the advantages of the atomizing deaerator. Publication 3005 discusses all types of deaerators with particular emphasis on the tray type. Ask for either or both. Cochrane Corporation.

18—See page 43. Feedwater Heaters: See chart on page 43 which shows you how much fuel you save by utilizing residual energy in exhaust steam. In addition to this saving, a Swartwout feed water heater will improve boiler operations—faster; temperature strain relief; removal by deaeration of soluble gases that cause boiler and economizer corrosion. Write for Bulletin S-18-E, The Swartwout Company.

19—See page 172. Well Water Systems: Yours for the asking—catalogs and bulletins fully describing Layne Well Water Systems. The unfailing service and many advantages of this completely dependable system make the purchase price even more reasonable. Layne & Bowler, Inc.

CLEANERS AND BLOWERS

20—See page 54. Portable, Heavy-Duty Suction Equipment: Removes grindings, bolts, nuts, rivets, etc. from interior recesses—serves efficiently on all industrial waste removal or material recovery jobs. Write for free booklet. Invincible Vacuum Cleaner Mfg. Co.

21—See page 167. Combination Blower-Suction Cleaner: It's a snap to rid all of your equipment of damaging dirt, dust, and grit with this portable cleaning tool. 5 models with attachments for every cleaning job. Write for more data. Clements Mfg. Co.

22—See page 169. Portable Electric Blower: Protect motors and other equipment from burnouts and bearing failure by removing dangerous dust, dirt and lint. Write for Bulletin 579 for complete information on the TORNADO. Breuer Electric Mfg. Co.

23—See page 150. Vacuum Cleaning Equipment: Portable cleaners or stationary cleaning systems provide an economical solution to the problem of removing troublesome dust accumulations in industrial plants. Write now for bulletin and free survey. U. S. Hoffman Machinery Corp.

149—See page 173. YC Compressors: Bulletin L-667-B1A will give you the whole story on these compact compressors with 3- and 5-step variable capacity control. Worthington Pump & Machinery Corp., Compressor Div.

COMPRESSORS

24—See page 132. Motor Driven Compressors: Write for Bulletin 4910 which contains full details and operating data on Schramm's complete line of motor driven compressors. You're sure to find the right combination for your job. Schramm, Inc.

25—See page 65. Steam-Driven Compressor: Capacities of the Type H range from 900 to 7400 cfm, 100 to 125 pounds pressure. Other sizes of CP steam-driven compressors are available in single and multi-stage designs for lower and higher pressures. Get full details by writing for Bulletin 729. Chicago Pneumatic Tool Company.

DIESEL POWER

26—See page 58. Superior Diesels: Be sure to read the remarkable success story on page 58 which can be duplicated for you. A Superior representative will be glad to call and give you personalized help. Or write for the fully illustrated 20-page booklet. The National Supply Company.

27—See page 52. Diesel Engines: If you're looking for reliability and long life in your diesel engines, then you should have complete information on Cooper-Bessemer 52 dragline, marine, stationary, locomotive, or any other heavy-duty power application. Mail your inquiry today for full facts. The Cooper-Bessemer Corporation.

DUST & FLY ASH COLLECTING EQUIPMENT

28—See page 27. Fanmix Gas and Oil Burners: Bulletin 410-6 gives complete data on Coppus-Dennis Fanmix burners that allow you to get more heat release per cu. ft. of furnace volume. Coppus Engineering Corp.

29—See page 157. Aeroturn Dust Collector: New Bag-Type Dust Collector featuring automatic continuous cleaning and a 99.9% plus dust collecting efficiency. 50% to 75% smaller, and lighter in weight than previous models. Filtering rates run as high as 60 feet per minute. Free analysis of dust samples and comparison test. Send for Aeroturn literature today. Turner & Haws Engineering Company, Inc.

ELECTRICAL EQUIPMENT

30—See pages 60, 61. Fusetrons: A fuse to which is added a thermal cutout offers large time-lag and less electrical resistance. Fits standard fuse blocks and may be used throughout entire electric system. Send for complete facts. Bussman Mfg. Co.

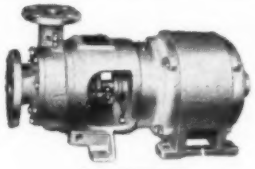
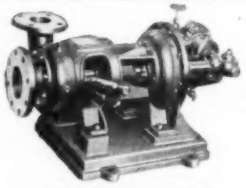
31—See page 66. Wound Rotor Motors: Ideal for applications requiring high starting torque or low starting current, or to meet conditions where varying speed is required. Write for more details plus information on Century's complete line of electric motors. Century Electric Co.

32—See page 42. All-New HCI Safety Switch: For modern high-capacity distribution systems. Breaks heavy loads quickly, safely. Withstands heavy short circuits without damage. 30-, 60-, 100-ampere sizes. For

(Continued on page 24)

Do you need a SPECIAL PUMP?

No matter how special your requirements, you may get exactly what you want, from ¼ to 40 hp, from this complete line of Ingersoll-Rand Motorpumps:

	HEAVY DUTY	STANDARD DUTY		MODIFICATIONS
 MOTORPUMPS	Single Stage 10 to 1800 gpm Heads to 240 ft. Two Stage 20 to 275 gpm Heads to 500 ft.	Single Stage 5 to 250 gpm Heads to 175 ft. Two Stage 5 to 55 gpm Heads to 300 ft. Four Stage 5 to 50 gpm Heads 300 to 600 ft.	Can be supplied with any desired type of direct-connected motor – single or polyphase, a-c or d-c; open, splash-proof, totally enclosed fan cooled, explosion proof or marine type.	Open impellers for handling liquids containing suspended material are available on most sizes of Motorpumps and Cradle-Mounted Pumps. To avoid leakage under unusual conditions, Cameron mechanical shaft seals, smothering type glands, or Merco - Nordstrom grease seals can be supplied. Casings and impellers can be built of special materials where required.
CRADLE-MOUNTED PUMPS	Single Stage 10 to 1800 gpm Heads to 240 ft. Two Stage 20 to 275 gpm Heads to 500 ft.	Single Stage 5 to 250 gpm Heads to 175 ft. Two Stage 5 to 55 gpm Heads to 300 ft.	Can be supplied with any type of motor (as above)– direct-coupled, gear driven, or V-belt driven. Also available with steam turbine or gasoline engine drive.	
CIRCULATING AND COOLANT PUMPS	Single Stage 5 to 150 gpm Heads to 125 ft.		Available in three types; 1) Immersion type (pump submerged in liquid) 2) External type, with side-wall mounting bracket 3) External type with bracket for horizontal mounting	
 TURBINE-DRIVEN PUMPS	Single Stage 5 to 1800 gpm Heads to 240 ft. Two Stage 5 to 275 gpm Heads to 500 ft. Four Stage 5 to 50 gpm Heads 300 to 600 ft.		Centrifugal pump element same as in Motorpumps – but direct-connected to a velocity stage, impulse type, steam turbine. Particularly applicable to refinery, process and gas plant service.	

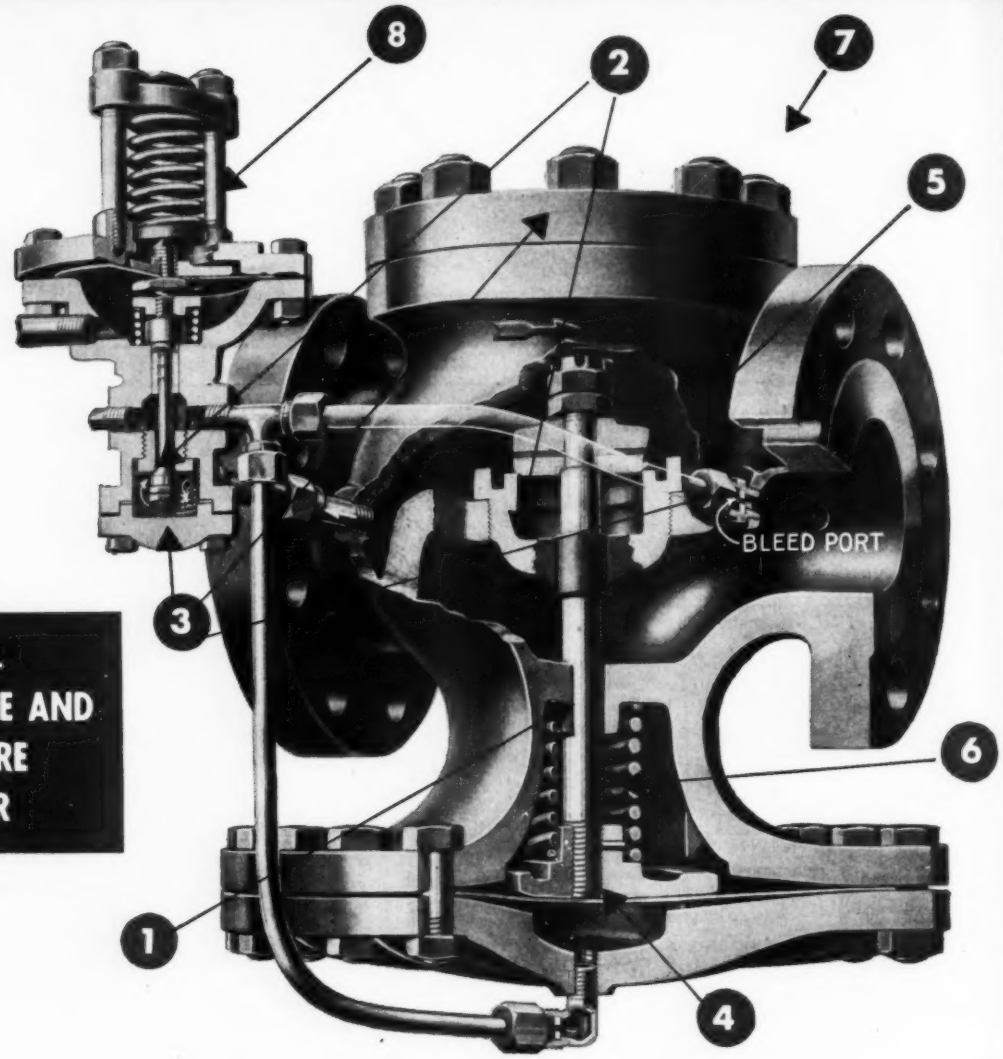
These standard I-R Motorpumps are available for prompt delivery–from the factory, or from nearby District Office stocks. Even your so-called "special" requirements can be met quickly from our complete line of standard pump parts. Whatever your pump problem, your nearest I-R representative is qualified to give you expert assistance.

THE CAMERON MOTOR PUMP
A PRODUCT OF

Ingersoll-Rand
11 BROADWAY, NEW YORK 4, N. Y. 472-9

COMPRESSORS · AIR TOOLS · ROCK DRILLS · TURBO BLOWERS · CONDENSERS · CENTRIFUGAL PUMPS · OIL AND GAS ENGINES

THESE SPENCE FEATURES Reduce M



A TYPICAL
SPENCE PRESSURE AND TEMPERATURE REGULATOR

LESS DOWN-TIME of the system! Less time and money wasted on replacement of parts! Thousands of installations throughout the country have proved that Spence Self-Operated Regulators stay "on the line" . . . provide *dependable, trouble-free* pressure and temperature control. Users know these precision-engineered Spence units rarely need extensive repairs or special attention. Here are a few of the Spence design features that help keep *maintenance at a minimum:*

1 **PACKLESS CONSTRUCTION**—All Spence main valves and most pilots are built without stuffing boxes. This packless construction saves many maintenance man-hours because it eliminates the need for closely fitted parts which may stick or bind due to uneven expansion or foreign matter.

2 **EASY TO CLEAN**—The seat and disc of the main valve and pilot can be cleaned and any working part removed *without taking the main valve out of the line.*

3 **NO DISMANTLING FOR INSPECTION**—Special openings are provided to inspect the main valve disc, the pilot valve member and the SECO Metal bleedport. Inspection is easier, too, because the pilot is not an integral part of the main valve. The pilot is protected by an accessible built-in strainer.

4 **LONG-LIFE METAL DIAPHRAGMS**—Spence metal diaphragms, under usual conditions, never require replacement. Spence Regulators have few moving parts and those few are ruggedly constructed and seldom require attention.

SPENCE PRESSURE *and* TEMPERATUR R

ce Maintenance...Cut Costs

BUILT TO LAST FOR YEARS!

That's the reason Spence Self-Operated Regulators lower over-all costs. Dollar for dollar, you can count on quality performance for a longer period of time. Look at three of many Spence features that assure long regulator life:

5 DURABLE SECO METAL SEATS AND DISCS—Spence seats and discs are made of durable SECO Metal which resists wiredrawing. *More than twenty years of experience* with SECO Metal in thousands of installations has failed to produce a single case where SECO Metal has been cut by steam.

6 SPRING OUT OF PATH OF STEAM—The spring in the Spence Regulator is out of the path of high-pressure steam or other fluids flowing through the valve. Since the spring operates at low unit stress, it has exceptionally long life.

7 LESS FRICTION—All Spence Regulators are built with *packless* main valves which are actuated by large, balanced diaphragms. This design minimizes friction. Valves remain unaffected by changes in service conditions or length of service.

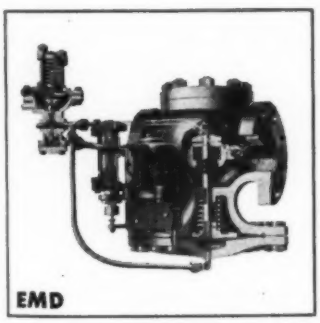
WHY SPENCE UNITS REGULATE ACCURATELY

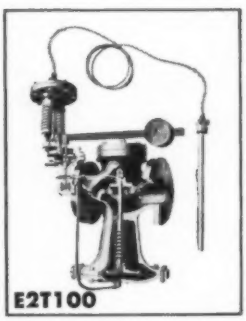
8 YOU CAN BE SURE of accurate regulation because *sensitive* pressure or temperature pilots control the main valve of every Spence unit. This unique design enables the Spence Regulator to serve many functions and handle all the various types of fluids under a wide range of conditions.

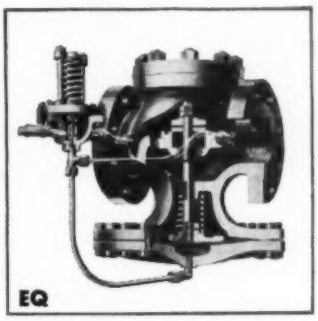
One of the great advantages of this Spence design is the interchangeability of all pilots on all sizes of main valves. Any main valve can be changed from a pressure to a temperature regulator or vice versa *simply by substituting one type of pilot for another.*

WIDE RANGE OF SIZES

Spence Regulators are built in sizes from *¼" to 12"* for service with *air, steam, water, oil or gas.* With minor adjustments, any Spence Regulator can be easily switched from one service to another.



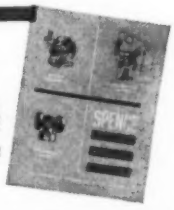




The Type **EMD** Pressure Regulator includes a SPENCE Solenoid Pilot to cut it on and off electrically • The Type **E2T100** Temperature Regulator in effect is a pressure regulator which is constantly reset by small variations in temperature at the sensitive thermostat. • The Type **EQ** Back Pressure Regulator is a self-operated, packless unit which controls its own initial pressure. The general construction is the same as the Type ED Pressure Regulator.

FREE BULLETIN GIVES ALL THE FACTS

YOU WILL FIND complete engineering details and selection data on Spence Regulators in free bulletin No. 5000. It features a *full color, fully illustrated description of the operating cycle* of a Spence Regulator. Send for your copy of this valuable bulletin today.



SPENCE ENGINEERING COMPANY, INC.
WALDEN, NEW YORK

PARTIAL LIST OF USERS

- The Cleveland-Cliffs Iron Company
- Tennessee Coal, Iron and Railroad Company
- The Springs Cotton Mills
- Ford Motor Company
- Cochrane Corporation
- Philadelphia Electric Company
- Pennsylvania Power & Light Company
- L. H. Gilmer Company Div. of United States Rubber Co.
- York Corporation
- Jones & Laughlin Steel Corporation
- The Duluth Steam Corporation
- Rochester Gas and Electric Corporation
- Consolidated Gas Electric Light and Power Company of Baltimore
- Phenix Natural Gas Company
- Cutter Laboratories
- National Tube Company
- The Atlantic Refining Company
- Great Lakes Steel Corporation
- Union Electric Company of Missouri
- Todd Shipyards Corporation
- Oxford Miami Paper Company
- Land O'Lakes Creameries, Inc.
- Ohio Edison Company
- General Electric Company
- R. J. Reynolds Tobacco Company

Spence

REGULATORS

Clark *presents* DUO-STEP

A REVOLUTIONARY *NEW IDEA* IN STEAM TRAP CONSTRUCTION!

CLARK DUO-STEP "SHIFTS GEARS" TO DOUBLE DRAINAGE CAPACITY!

Double drainage capacity means double value for steam trap users! Because it increases drainage capacity over 100% Clark Duo-Step Leverage makes it possible to use *smaller, less expensive* steam traps for big volume drainage jobs.

This is accomplished by using TWO fulcrum points — one for power to "crack" the valve from the orifice and one to move the valve *away* from the orifice.

Send for the whole DUO-STEP story *today,* and start saving money on your steam trap requirements.

THE CLARK MANUFACTURING CO.
1846 East 38th St., Cleveland 14, Ohio

SEND FOR THE AMAZING DUO-STEP STORY TODAY!

Please send me the Duo-Step story:

NAME_____

COMPANY_____

STREET_____

CITY_____ STATE_____

READERS' GUIDE

(Continued from page 20)

more information, write for your free copy of Bulletin TEC-10. The Trumbull Electric Manufacturing Company.

33—See page 53. G-E Capacitors: A NEW BOOKLET explains how capacitors work and gives specific data to show you what you may expect from them. Write today for Bulletin GEA-5167. Apparatus Dept., General Electric Co.

34—See page 109. Mica-Glas Insulated Coils: Write for more information about the services of the National Field Engineer. National's experience can pay off in lower maintenance cost for rotating electrical machinery in your plant. National Electric Coil Company.

35—See page 121. Time-Delay Fuses: New Economy Catalog gives full data on renewable cartridge fuses for protection where time delay is most needed—135 to 200% overloads. Economy Fuse and Mfg. Co.

36—See page 45. Type H Starters: Oil or Air—whichever contactor is best suited to your application can be built into Allis-Chalmers Type H Starters. For full or reduced-voltage starting, reversing or dynamic braking of squirrel-cage, wound rotor or synchronous motors. More information at your request. Also ask for Bulletin 14B7303 on Type 256 Air Break Contactor. Allis-Chalmers.

37—See pages 18, 19. I-T-E Switchgear: If you have any questions on modern HV switchgear construction, send for Bulletin 7000-A on I-T-E's newest 5 KV Switchgear. Also request Bulletin 6003-D a complete reference guide to I-T-E 600V Switchgear assemblies. I-T-E Circuit Breaker Co.

FLOOR REPAIRS

38—See page 164. Tough Resurfacer: Rugged-Wear resurfacer stands up under the most punishing traffic conditions. For broken concrete or wood floors. Makes durable patch or complete overlay. Used indoors or out. Dries fast. Send for free trial offer and complete information. No obligation. Flexrock Company.

39—See page 167. Instant-Use Floor Patch: Tough, plastic material which restores broken concrete to solid smoothness. Run traffic over it immediately. Write for details of free trial offer and complete information. Flexrock Co.

FUELS AND FIRING EQUIPMENT

40—See page 57. Industrial Coal: Graham, Browder, and Powerhouse—these three trade-marked coals are dependable guides to high efficiency and low cost. Test the one recommended for your plant by Southern Coal Company's engineers. Write for profitable engineering counsel today. Southern Coal Company, Inc.

41—See page 44. Canton Stokers: If you're looking for a dependable, economical answer to your power and heating problems, ask for the services of the Canton Stoker Field Sales Engineers. He will be pleased to help you without obligation. Canton Stoker Corporation.

42—See page 138. Stoker-Veyor: Ask for Bulletin 916. Completely describes Stoker-Veyor—speeds filling of hopper and removal of ashes. American Conveyor Co.

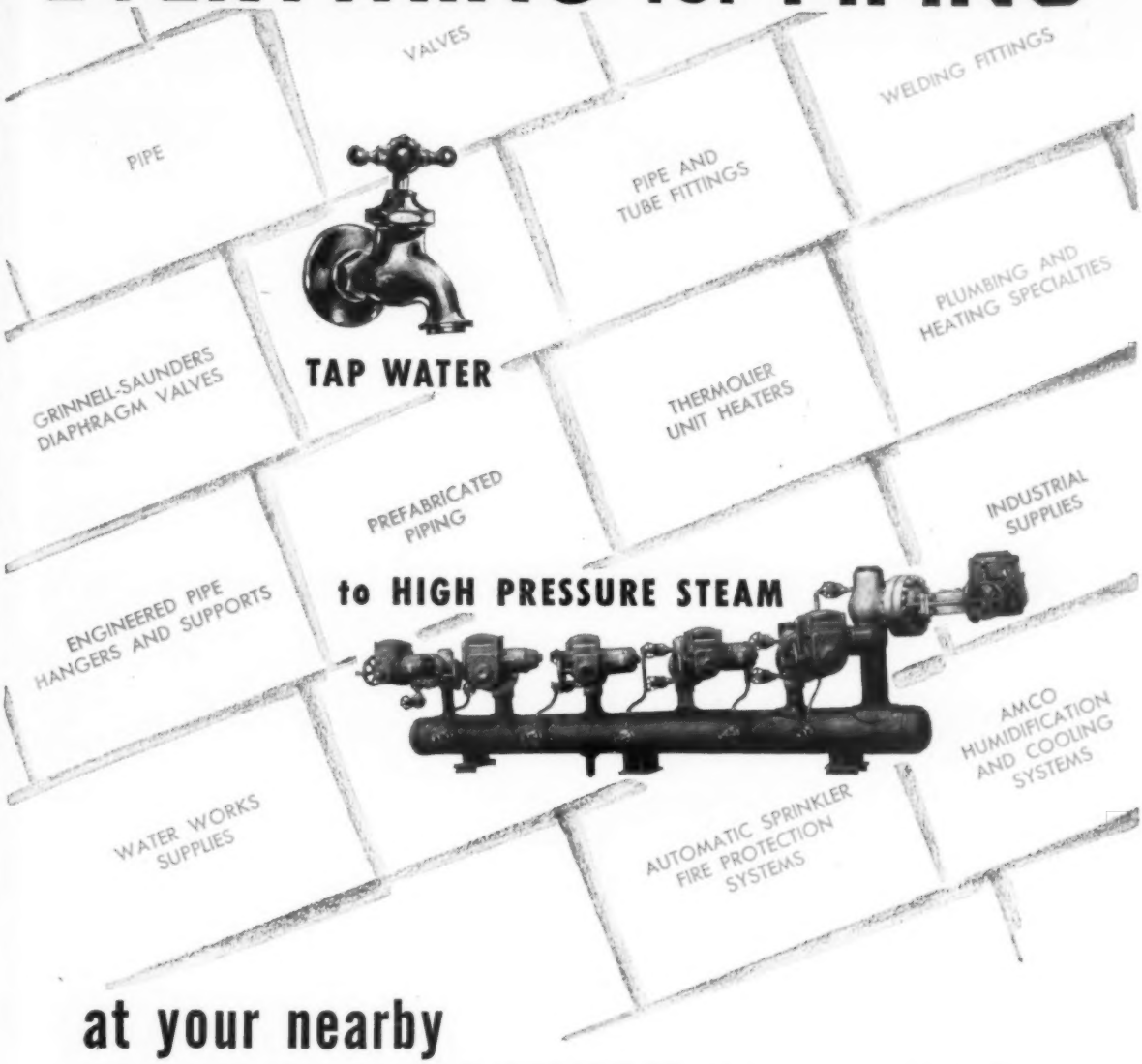
43—See pages 32, 33. Centrafire With Traveling Grate: Extra engineering refinements to spreader-type firing. Positive, metered flow of coal. Proper distribution is effected automatically. All moving elements are hydraulically operated by one turbine or motor-driven oil pump. Range extends up to 300,000 lbs. of steam per hour. Write for complete Centrafire story. Westinghouse Electric Corporation.

HEATING, VENTILATING AND AIR CONDITIONING

44—See page 145. Water Heater: Illustrated bulletin describes a new development in water heaters. Uses high pressure steam, requires only 3 pipe connections, and delivers 200 to 3000 gal per hr at safe temperature. The Coe Manufacturing Co.

(Continued on page 26)

EVERYTHING for PIPING



at your nearby GRINNELL WAREHOUSE or JOBBER

More than 1000 Grinnell warehouses and jobbers . . . one within easy reach of your phone . . . are ready to give you prompt delivery on any standard piping product. When the job calls for specialized piping products or installations, Grinnell has the manufacturing facilities, products, experience and engineering knowledge to "deliver the goods."

100th ANNIVERSARY — WHEREVER PIPING IS INVOLVED

GRINNELL

Grinnell Company, Inc., Providence 1, R. I. Warehouses: Atlanta • Buffalo • Charlotte • Chicago • Cleveland • Cranston • Fresno • Kansas City • Houston • Long Beach Los Angeles • Milwaukee • Minneapolis • New York • Oakland • Philadelphia • Pocatello • Sacramento • St. Louis • St. Paul • San Francisco • Seattle • Spokane

READERS' GUIDE ... CONTINUED ...

(Continued from page 24)

45—See page 144. Air Conditioning: Niagara "Controlled Humidity Method" gives complete control of temperature and relative humidity. Provides dry air at normal atmospheric temperatures with little or no refrigeration. Read this informative advertisement then write for additional data. Niagara Blower Co.

46—See page 153. Automatic Gas-Fired Unit Heaters: Write for complete information on the New Reznor 1950 Automatic Gas-Fired Heater. Clean, low-cost heat for large and small areas. Reznor Manufacturing Company.

47—See page 171. Self-Washing Filters: Sturdy construction, few mechanical parts and automatic washing and oiling feature reduce maintenance to occasional inspections. Built-in fire protection makes these units safe to use. Easy to install. Will handle any CFM requirement. Complete literature free upon request. Farr Company.

48—See page 159. Oil Heaters: Complete sets with steam electric pumps. All piping connected and ready to install. Standard sizes up to 50 GPH of No. 6 fuel oil. Accessories to suit. Write for Free Bulletin describing these complete oil heating sets. Leyman Manufacturing Corp.

49—See page 69. Radiant Heaters: Uniform, exact heat when you want it is yours at the turn of a dial when you use Chromalox Electric Radiant Heaters as your heat source for infrared drying, preheating, baking, curing, dehydrating and similar applications. Full details sent on request. Edwin L. Wiegand Company.

50—See page 4. New Wall-Fin Heaters: Trane offers you "continuous run" finned-type radiation in standard sizes for tailor-made installation—completely cabinet covered. Easy to install—maximum flexibility. Contact your nearest Trane representative or write direct for further details. The Trane Company.

51—See page 174. Help With Your Air-Moving Job: Now you can take full advantage of Hartzell engineering, longest experienced in the propeller-type fan industry, to work on your air-moving problems. See page 174 for coupon which offers you this free service without obligation. Hartzell Propeller Fan Co.

HEAT EXCHANGERS

52—See page 55. Marley Cooling Towers: See page 55 for coupon offering free Marley's latest illustrated folders entitled, "What's Your Cooling Tower I. Q.?" A Marley Application Engineer will gladly call to discuss your water cooling problem. The Marley Company, Inc.

INSTRUMENTS

53—See page 137. New Liquid Level Gage: Sensational new gage—the Jerguson Truscale gage—gives you important new features for distance reading of liquid level in boilers, deaerating tanks, etc. Sensitive and accurate. New alarm system. Write for Truscale Data Unit. Jerguson Gage & Valve Company.

54—See page 135. All-Metal Thermometers: Easy readability, combined with rugged, all-metal construction, assures long-time dependability. Thermometers for most industrial applications — wide variety of types. Write for literature. Weston Electrical Instrument Corp.

55—See page 165. How to Cut Production Costs: Bowser offers free to plant executives proved ways to reduce labor, steam production, prevent inventory losses and minimize maintenance. Some of them may be just what your plant needs. Write today for your copies of this data. Bowser, Inc.

56—See page 154. Severe Service Thermometers: Ask for Bulletin "E" for full information on the "Princo" thermometer built for those really tough service connections. Ask for prices and description of the new dial thermometer, too. Precision Thermometer & Instrument Company.

57—See page 162. Flow Indicators: Write for Bulletin S-1 for specifications of Ernst Sight Flow Indicators. Bulletin also contains details on gage glass guards of nonbreakable plastic, flat gage glasses, calibrated gage glasses, rubber gage glass gaskets, brushes, and glass cutters. Ernst Water Column & Gage Co.

58—See page 161. Extra Protection: Write for more information and descriptive Bulletin covering FLO-GAGE. Now, this compact rate of flow indicator packs another big feature: positive, automatic protection against overloads and reverse differentials! Builders-Providence, Inc.

59—See page 166. Automatic Liquid Measuring Gages: Write for complete details on liquid level gages for measuring liquids on all kinds. Dial readings in feet, inches, gallons, pounds or any desired units. The Liquidometer Corp.

INSULATION

60—See page 59. Insulating Cement: Send for free copy of catalog, "Industrial Insulation", which describes B-H No. 1 cement and other Baldwin-Hill Insulations. Baldwin-Hill Co.

LUBRICANTS AND FILTERS: PURIFIERS AND LUBRICATORS

61—See page 103. Colloidal Graphite: Send for your copy of the New Acheson Bulletin No. 424 on the subject "dag" colloidal graphite for industrial lubrication. See how it will pay you to incorporate "dag" colloidal graphite into your present lubricants. Acheson Colloids Corp.

62—See page 169. Automatic Oilers: Write for your FREE copy of "On The Job" Trico Oiler Installation book and more information on automatic lubrication. Trico Fuse Mfg. Co.

63—See page 159. Centralized Lubrication: Ask for free Catalog No. 25 and Case Studies showing how to save oiling labor, bearing expense, production time and lubricant. The Farval Corporation.

64—See page 47. 11 Ways to Cut Production Costs: Write for your copy of this free, new booklet which is yours without obligation. You will find handy coupon on page 47. Alemite Corporation.

65—See page 151. Non-Fluid Oil: Send for instructive bulletin and free testing sample of Non-Fluid Oil for a positive bearing protection. New York & New Jersey Lubricant Company.

66—See pages 35, 36. Nonpareil and Stanoil: Test this guarantee: with each fill of Nonpariel a written guarantee is given that the oil will last as long as the turbine and its acidity will stay below a neutralization number of 0.15 mg. KOH/gm. Also ask about Stanoil, the multi-purpose industrial oil containing an oxidation inhibitor and an anti-foam additive. Standard Oil Company (Indiana).

MAINTENANCE

67—See page 168. Free Repair Handbook: Filled with time-saving, money-saving uses for Smooth-On in plants and shops. Clear, practical directions. 170 diagrams. Send today for your copy. Smooth-On Mfg. Co.

68—See page 51. Rust Preventive: Rust-Oleum seals metal so that no rust-causing oxygen can reach it. Available in a full range of colors. Write for complete catalog. Rust-Oleum Corp.

69—See page 114. Pipe Joint Sealing Compounds: Pipe joints and fittings sealed with Key sealing compounds do not leak. Connections will not freeze and reopening is easy. Send for free sample. Key Company.

70—See page 154. NEW, FREE Handbook: Write for your copy of "Commutator and Slip Ring Maintenance". Contains authoritative information on commutator slip ring maintenance. Fully illustrated. Forty pages of facts. Ideal Industries, Inc.

71—See page 170. Complete Service for Elevated Water Tanks: 30 years' experience means safety, service, and satisfaction on every water tank reconditioned by Dixie Tank and Bridge Co. Write for your free copy of publication, "Sound Principles of Water Tank Maintenance and Tank Talk". Dixie Tank and Bridge Co.

MATERIAL HANDLING

72—See page 146. Pneumatic Conveyors: Write today for full details proving pneumatic conveyors can reduce your handling costs. You have less labor cost, no material waste, and better working conditions. Dracco Corp.

73—See page 17. Coal and Ash Handling Equipment: A Fairchild engineer will gladly discuss your handling problems to help you cut labor cost and increase cleanliness and efficiency. Write today for his services 17 no obligation. The Fairfield Engineering Company.

74—See page 67. Bulk Materials Handling Systems: Long experience has given Stephens-Adamson Engineers the "know-how" that cracks bulk materials handling problems quickly and economically. Their staff is at your service. Write them today. Stephens-Adamson Mfg. Co.

75—See page 164. Krane Kar: Gasoline powered. Works inside and outside your plant. Handles loads at front or sides. Don't wait to get more information. Ask for Bulletin No. 79 or for a Sales-Engineer. Silent Hoist & Crane Co.

76—See page 50. Belt Idlers: Whether yardage looms large in the estimate, or small capacity is desired, Jeffrey engineers are skilled in the application of material handling to every job in your plant. Write for your copy of Catalog No. 785 and get the complete, important information. The Jeffrey Manufacturing Company.

77—See page 139. "Coal Handling Equipment": If you plan to modernize your present coal storage and handling equipment or to install a new system, you'll find this G-W Bulletin No. 300 extremely helpful . . . and most profitable. Write today for your free copy. Gifford-Wood Co.

78—See page 148. New Car Shakeout: Model GS—rugged and powerful, yet designed to the smaller-size plant. Unloads up to 15 cars a day but economical for only 2 or 3 cars a day. Ask for full details on this and the Model HD for heavy duty, high speed unloading. Hewitt-Robins, Inc.

PACKINGS AND GASKETS

79—See page 147. Durametallic Packings: It will pay you in many ways to use this custom-built packing. Your first step is to send for File No. DMIP covering Durametallic and Dura Plastic Packings. Durametallic Corporation.

80—See page 140. Packings: Descriptive literature is offered on self lubricating Palmetto Packings for every condition of service. Greene Tweed & Co.

81—See page 119. Severe-Duty Packing: Remains resilient at high temperatures. Will not harden, even at 1200° F. Easily withstands pressures as high as 2000 psi. Style 177AI is newest "John Crane" quality packings. Send for the complete "John Crane" Catalog. Its recommendations can be a real help to you. Crane Packing Company.

PIPE AND FITTINGS

82—See page 163. Flexible Metallic Hose: Seamless or interlocking, for every known application. Also hose built to your specifications. Write for latest development bulletins. Atlantic Metal Hose Co.

(Continued on page 154)

You get MORE CAPACITY with a FANMIX BURNER

Increase Boiler Ratings On Present Or Planned Equipment

In all types of Coppus-Dennis FANMIX Burners — straight gas or combination gas-oil — we utilize the energy of the fuel under pressure to drive the burner fan and deliver air in the proper proportion to the fuel flow. This exclusive "pinwheel action" *mechanically* mixes fuel and air in exactly the right proportions for truly radiant, non-luminous heat.

The result is uniform temperature everywhere in the combustion chamber — no drifting "hot spots" — and complete combustion under all conditions. That's why you can release more heat into your present furnace — why in new installations you get more heat into smaller furnace space.

FANMIX Saves On Both Old and New Installations

FANMIX can easily be operated with your present furnace and stack, requiring only minor changes in other equipment. Or if you're planning on new boilers, remember that FANMIX relieves the furnace from the burden of mixing, creates its own forced draft and takes smaller pipe sizes. Which means you can plan on reduced combustion space, less stack, no forced draft equipment and lower installation costs all around.

Get the Whole Story

Coppus engineers FANMIX Burners to meet individual requirements, providing complete control over heat pattern and combustion . . . Learn more about how "pinwheel action" can step up *your* boiler performance to peak efficiency and economy — as it is doing throughout industry. Send for Bulletin 410-6. Coppus Engineering Corp., Worcester 2, Mass. Sales Offices in THOMAS' REGISTER. Other Coppus "Blue Ribbon" Products in BEST'S SAFETY DIRECTORY, CHEMICAL ENGINEERING CATALOG, REFINERY CATALOG, and MINING CATALOGS.

COPPUS ENGINEERING CORP.
183 Park Ave.
Worcester 2, Mass.
Please send Bulletin 410-6 to:
Name.....
Company.....
Address.....
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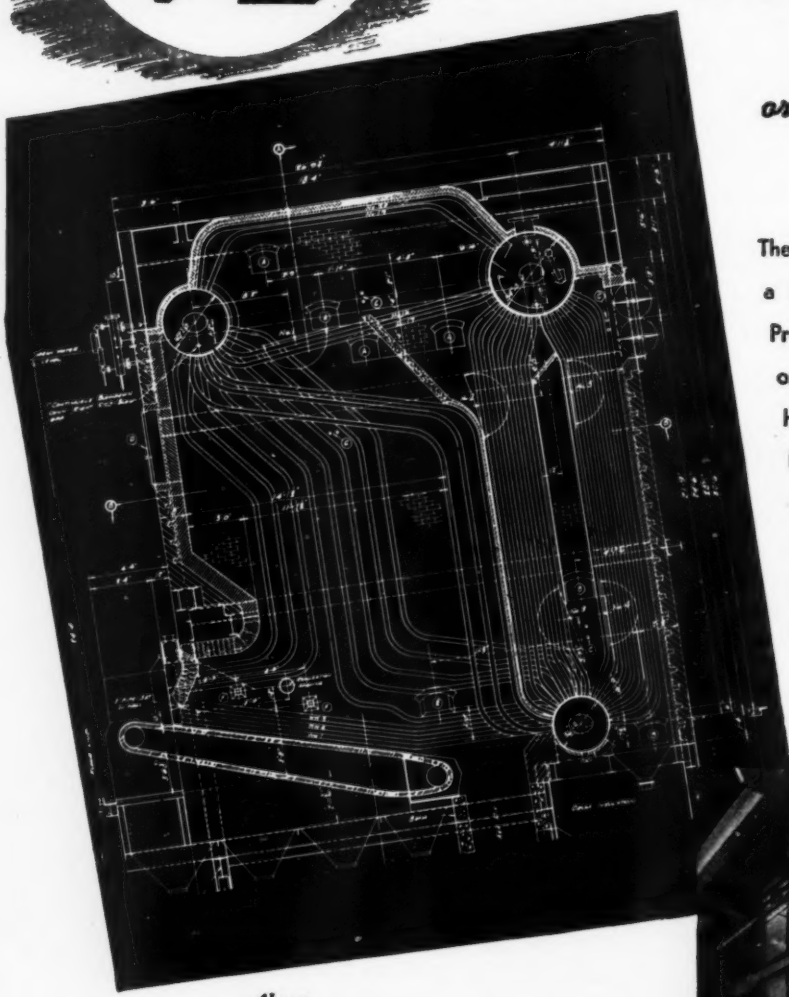
CLASS **VL**

Vogt Steam Generating Units

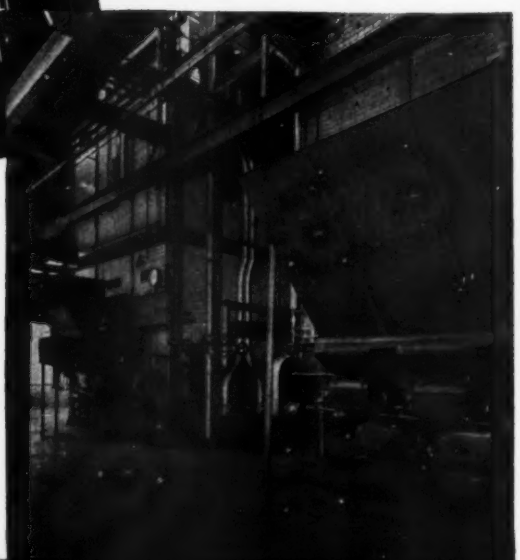
for POWER *or* PROCESSING LOADS, *and* HEATING



The design provides large furnace volume and a high ratio of radiant heating surface. Proper combustion is assured with any fuel or method of firing. Superheaters, air preheaters, economizers, water walls, and soot blowers can be readily incorporated. Vogt Class VL Steam generating units are giving satisfactory service in Hotels, Sugar Refineries, Steel Mills, Furniture Factories, Distilleries, Oil Refineries, and related industries. A bulletin showing typical installations will be sent upon request.

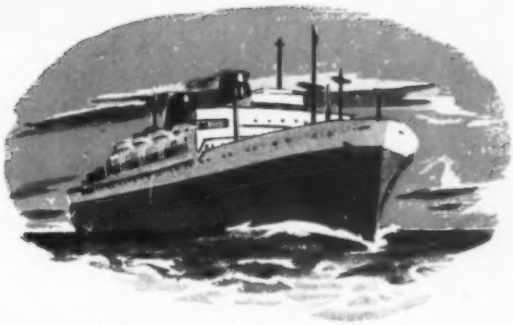
Above:
This 90,000 lbs. steam per hour unit, designed for 475 lbs. pressure, serves the Mansfield Tire & Rubber Co., Mansfield, Ohio.

Right:
Two 515 H.P. units installed in Brown-Forman Distillers Corporation, Louisville, Ky. Plant.



HENRY VOGT MACHINE CO. • 1000 W. Ormsby St., Louisville 10, Ky.
Branch Offices: New York, Philadelphia, Cleveland, Chicago, St. Louis, Dallas.

1. Before pulp becomes paper, long, trim lines of copper tube have conveyed pulp, stocks, "white water" and just plain water.



2. Engine rooms of great steamships are a maze of copper tubes carrying steam, hot water, cold water, sea water, fuel oil, and lubricating oil.

3. Copper tubes, more than any other kind of piping, form the "production lines" of the chemical and pharmaceutical industries.

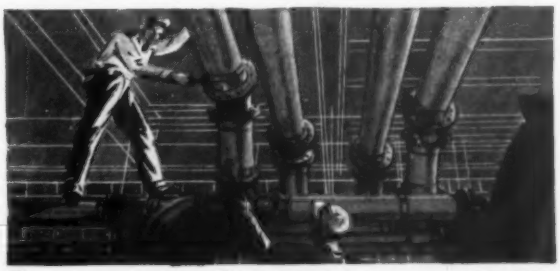
4. At the brewery, beer leads a sheltered life in immaculate copper equipment. Both wort and beer flow with impunity through copper tube lines.

Where rust won't do . . .

COPPER will!

WHETHER you write a letter, read a book, drink a glass of beer, raid your icebox, turn on your oil burner, ride in a motor boat or an ocean liner, copper tubes are serving you. And when you take a pill, chances are that copper tubes helped to make it . . . and to fill your glass with water, too!

All-in-all, millions of feet of copper tubes, of many sizes and types, are at your service right this minute . . . and more of it carries the Anaconda name than any other.



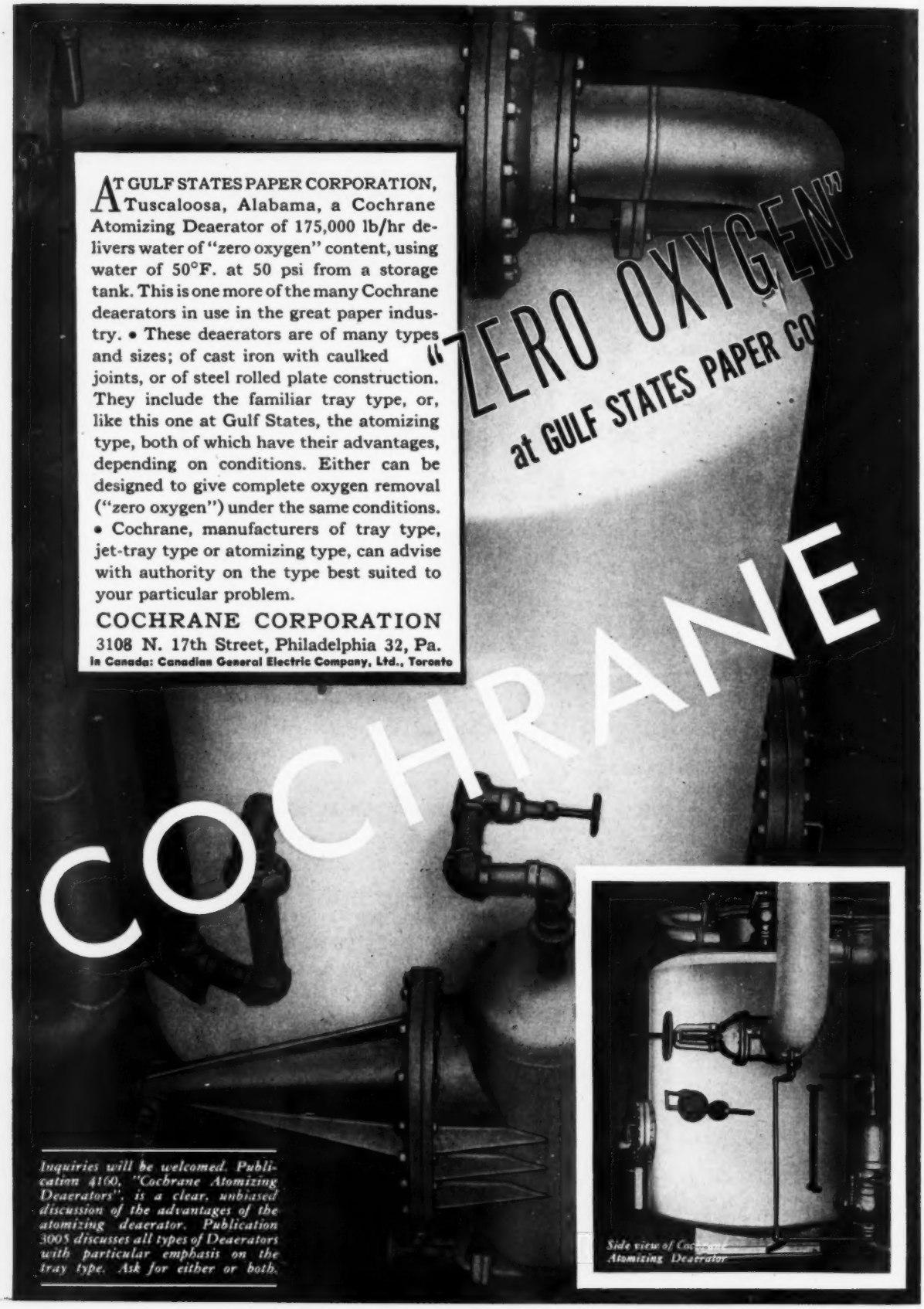
Anaconda Copper Tubes

ANACONDA **THE AMERICAN BRASS COMPANY**

General Offices: Waterbury 88, Connecticut

Subsidiary of Anaconda Copper Mining Company

In Canada: ANACONDA AMERICAN BRASS LTD., *New Toronto, Ont*



AT GULF STATES PAPER CORPORATION, Tuscaloosa, Alabama, a Cochrane Atomizing Deaerator of 175,000 lb/hr delivers water of "zero oxygen" content, using water of 50°F. at 50 psi from a storage tank. This is one more of the many Cochrane deaerators in use in the great paper industry. • These deaerators are of many types and sizes; of cast iron with caulked joints, or of steel rolled plate construction. They include the familiar tray type, or, like this one at Gulf States, the atomizing type, both of which have their advantages, depending on conditions. Either can be designed to give complete oxygen removal ("zero oxygen") under the same conditions. • Cochrane, manufacturers of tray type, jet-tray type or atomizing type, can advise with authority on the type best suited to your particular problem.

COCHRANE CORPORATION
3108 N. 17th Street, Philadelphia 32, Pa.
In Canada: Canadian General Electric Company, Ltd., Toronto

Inquiries will be welcomed. Publication 4160, "Cochrane Atomizing Deaerators", is a clear, unbiased discussion of the advantages of the atomizing deaerator. Publication 3005 discusses all types of Deaerators with particular emphasis on the tray type. Ask for either or both.

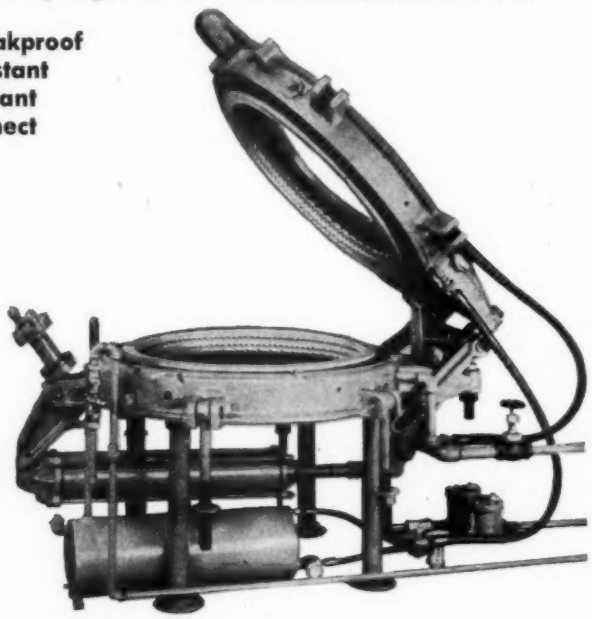
Side view of Cochrane Atomizing Deaerator

It's an "open and shut" case for flexible connectors

This tire re-capping machine opens and closes all day long. American Seamless Flexible Metal Tubing carries the hot steam in and out under pressure—safely, dependably, despite repeated flexing.

It's another example of how American Seamless Flexible Metal Tubing meets every requirement of the ideal flexible connector:

Seamless; leakproof
Pressure-resistant
Fatigue-resistant
Easy to connect



American Bronze Seamless Tubing carries steam to and from this automobile tire re-capping machine made by James C. Heintz & Company, Inc., Cleveland, O.

American Seamless Flexible Metal Tubing and American Flexible Metal Hose are made in a wide variety of styles and metals for conveying liquids, many chemicals, gases and semi-solids, under severe conditions of temperature, pressure and mechanical stress ... for protecting wiring and flexible driveshafts ... for connecting misaligned piping or ports.

If your equipment requires movable connectors, let us send you the complete story on American Flexible Metal Hose and Tubing, or let our Technical Department make recommendations. Write to The American Brass Company, American Metal Hose Branch, Waterbury 20, Connecticut. In Canada, The Canadian Fairbanks-Morse Co., Ltd.

50246

ANACONDA
from mine to consumer

wherever connectors must move... American

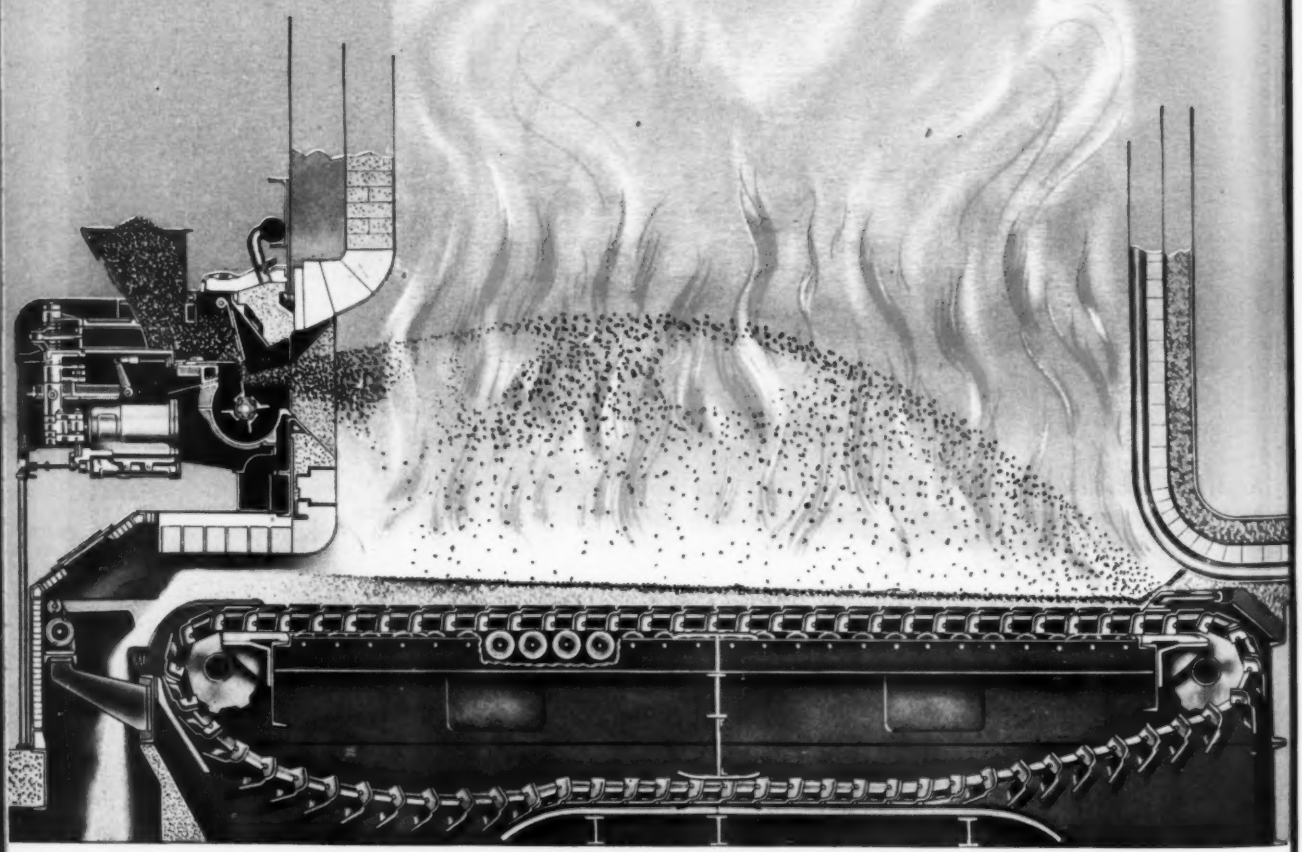
FLEXIBLE METAL HOSE AND TUBING

YOU CAN BE **SURE**.. IF IT'S

Westinghouse

CENTRAFIRE

with *Traveling Grate*



Westinghouse

STOKERS

. . . . . brings Extra Engineering Refinements To Spreader-Type Firing

The outstanding performance of the Centrafire with Traveling Grate stems from features that are built in—not added as accessories.

A positive, metered flow of coal, wet or dry, is fed continuously by an air-cooled overthrow rotor into the combustion area. Proper distribution is effected automatically by cyclic control of the rotor speed.

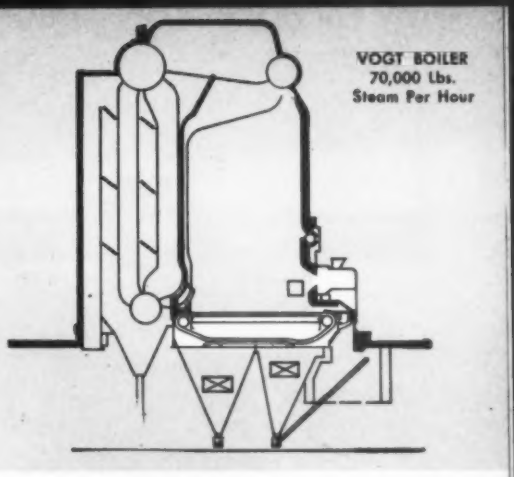
All moving elements are hydraulically operated by one turbine or motor-driven oil pump. This assures infinite flexibility through the complete range of operation—synchronizes coal feed and grate speed.

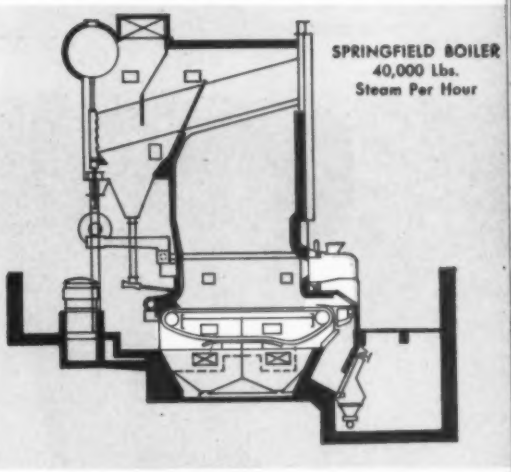
Grates are plate-type, laboratory tested under conditions far more severe than those of actual service. Rollers support the grate chains, reducing friction and power requirements.

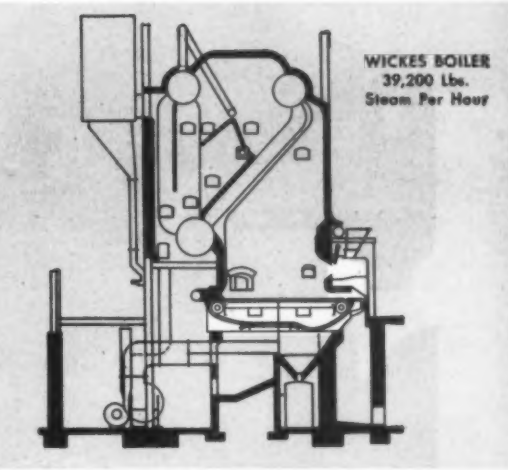
Fuel distribution adjusted automatically to air flow through front and rear grate sections results in intimate mixing of fuel and air for thorough combustion.

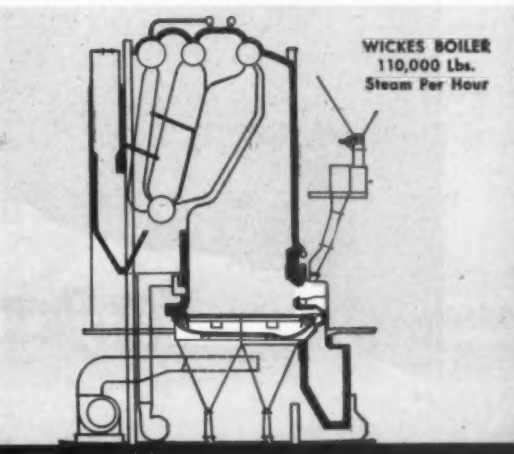
The Centrafire's range extends upward of 300,000 lbs. of steam per hour. Its adaptability to deep, narrow furnaces permits use of the most economical boilers.

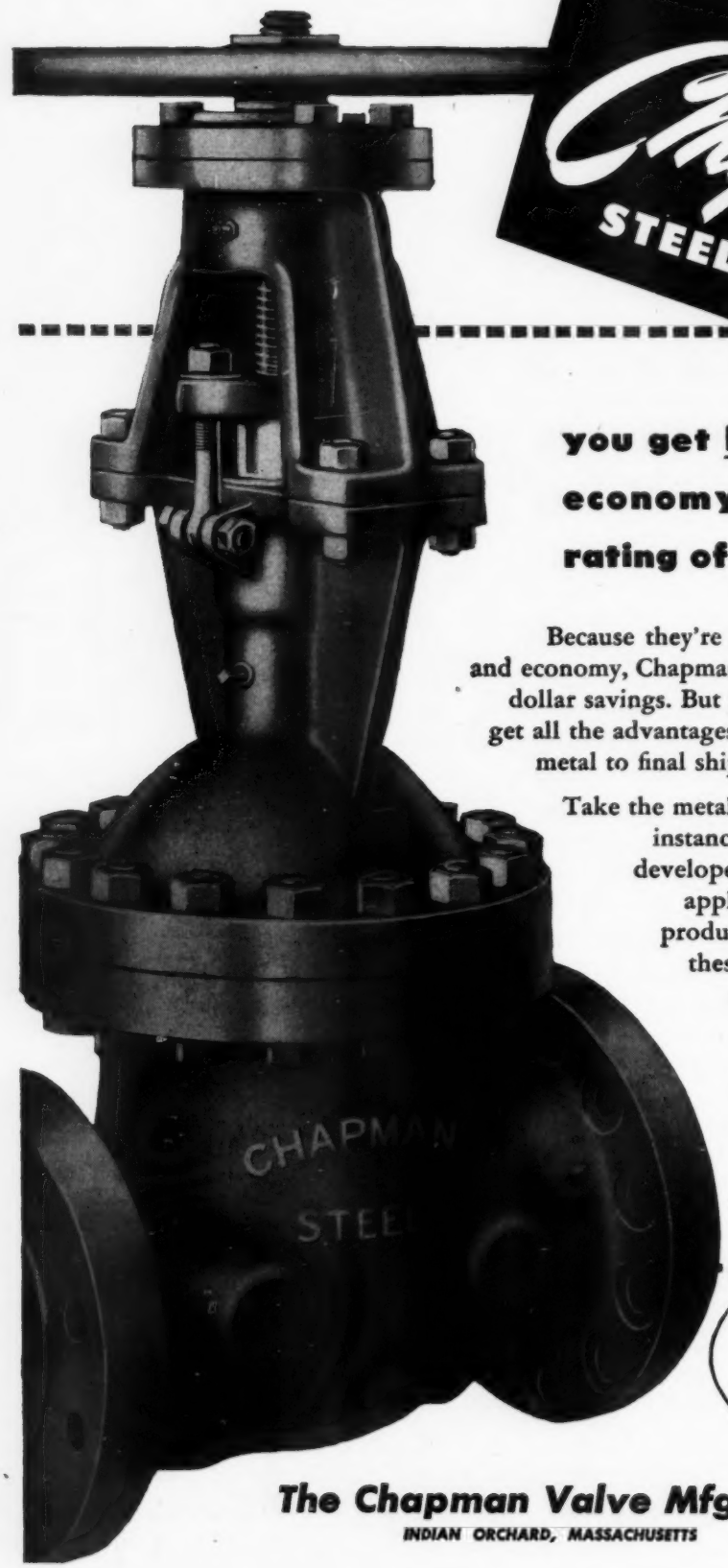
It will pay you to get the full Centrafire story. Ask your Westinghouse representative for complete data, or write Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pa. J-50504











WITH Chapman STEEL VALVES

you get <u>both</u> production-line economy <u>and</u> the precision rating of custom-made valves

Because they're made with production line speed and economy, Chapman Steel Valves offer you important dollar savings. But you get more than just that — you get all the advantages of close quality-control from raw metal to final shipment to you.

Take the metals these valves are made from, for instance. Chapman's own metallurgists developed the alloys best suited to each application. And they supervise the production of every operation each time these metals are produced in our own foundries. Just one of the many reasons why Chapman Steel Valves give you better service.

Why not write today for more information on these valves that offer you *both top quality and economy?*

The Chapman Valve Mfg. Co.
INDIAN ORCHARD, MASSACHUSETTS

Young turbine with a bright future . . .

● OFFICIALS of a midwest power company have every reason to believe that their new 40,000-KW turbine, shown above, will never have to be shut down for oil replacement, oil system cleaning, or because of oil acidity troubles. Their convictions are based on their own experience with Nonpareil Turbine Oil.

Since 1940, this company has put Nonpareil Turbine Oil into five big turbines, including the new unit. These five turbines have a total capacity of 188,500 KW. During the *one to nine years of operation* on Nonpareil, neutralization numbers have stayed below .06 mg. KOH/gm. There have been no time losses or troubles caused by high acidity. Oil systems have not required cleaning. Such benefits are assured this company, not only for 8 or 10 years, but for the *life* of its turbines. This assurance is based on Nonpareil's written guarantee that it will maintain a neutralization number below 0.15 mg. KOH/gm.

Why not end oil system maintenance and oil-acidity troubles, once and for all, by using Nonpareil Turbine Oil in your turbines? For more evidence of these savings, ask a Standard Oil Lubrication Engineer to supply you data from 20-year service records of Nonpareil Turbine Oil.

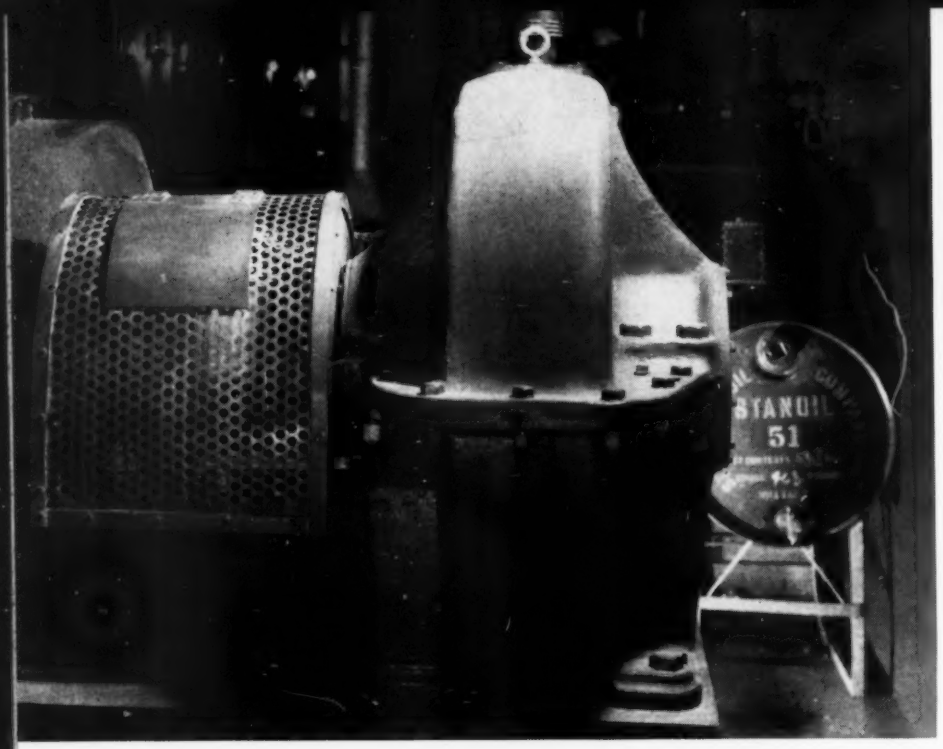
Write Standard Oil Company (Indiana), 910 South Michigan Avenue, Chicago 80, Illinois.

NONPAREIL
Turbine Oil

"Will outlast your turbine"

STANDARD OIL COMPANY (INDIANA)

STANDARD



Arrest the dirty work in reduction gears

THE dirty work starts in reduction gears when the lubricating oil begins to oxidize and break down under the attack of heat and air. Oxidation products, uniting with dust and other foreign matter, form deposits which interfere with proper lubrication and cause gear wear.

STANOIL
TRADE MARK
Industrial Oil

You can head off this dirty work—avoid costly cleaning jobs, oil changes, and gear wear—by using STANOIL Industrial Oil. The high stability of STANOIL prevents deterioration by heat. Its low-carbon-forming base oil keeps gears free from carbon. An inhibitor curbs acidity growth which would cause the formation of emulsions and sludge.

The many qualities of this one oil enable it to handle a wide variety of jobs in your plant. To assure you maximum benefits from STANOIL and other high-quality petroleum products, the Standard Oil Company has a well-trained and experienced lubrication specialist located practically at your doorstep. How you can profit by this unique product-service combination is explained at the right.

Standard Oil Company (Indiana), 910 S. Michigan Avenue, Chicago 80, Illinois.

What's YOUR problem?

• To help you solve particular lubrication problems or gain greater all-around economy, Standard Oil has set up an industrial service that's unrivalled in the Midwest. This service puts at your immediate disposal the help of a highly trained, experienced lubrication specialist and a reliable supply of petroleum products. All you need do is phone or address a card to the nearest Standard Oil Company (Indiana) office. In fact, why not start right now by arranging for the visit of the lubrication specialist assigned to your plant. With his help, find how many different oils in your plant can be replaced by STANOIL Industrial Oil on such applications as:

Hydraulic systems...cleaner operation, no foaming troubles.

Air compressors . . . no sticking or clogging of valves, less oil consumption in splash or circulating systems.

Speed reducers . . . less wear of gears and bearings during frequent cold starts or prolonged high-temperature operation.

Steam turbines... freedom from emulsions and sludge, fewer oil changes necessary.

Ring-oiled bearings . . . rings function immediately on starting, less bearing wear.

Circulating and bath systems ...one oil for a wide variety of jobs.

STANDARD **STANDARD OIL COMPANY (INDIANA**

These Two Valuable "Tools" of

V-BELT DRIVE

Design and Application

. . . are *Yours* for the *Asking!*

The Gates "GUIDE for SELECTING or DESIGNING V-BELT DRIVES" is widely recognized as the most *comprehensive* and *complete* book of its kind—and also the *easiest to use.* It enables you to find all the possible combinations of stock drives for your machine with the *least amount of calculation*—and almost *automatically* gives you the drive of *lowest price* that will be adequate for the job.

Saves You Time, Work and MONEY

The GUIDE tells all about "Design Horsepower" and Speed Ratios—and by merely *scanning* a page of GUIDE designs which use the *stock pulleys* that meet your needs, you can quickly determine the center distances that will fit your equipment layout while, at the same time, enabling you to use *standard belts!*

You Can Design ANY Drive

The Gates GUIDE tells *when* you can use a *V-Flat* drive—and gives you a simple way to choose a practical V-Flat design using *stock* driver sheave with whatever flat pulley you may already have on hand.

As a matter of fact, by using the Gates GUIDE you can design—with a *minimum of calculation—any kind* of V-Belt drive for every kind of operation—including quarter-turn drives and Dubl-V drives.

Written By GATES Engineers

The GUIDE is compiled and written by Gates Engineers. It embodies their specialized knowledge gained through operating the largest V-Belt testing laboratories in the world! Here, an average of *32,000 hours* of testing *per week* are run on V-Belts alone! No wonder the Gates "GUIDE for SELECTING or DESIGNING V-BELT DRIVES" is regarded by Engineers as the *authority* on V-Belt Drive design.

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World's Largest Makers of V-Belts
DENVER, U.S.A.

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I would like you to send me without cost or obligation—

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Position Held_____

Name of Firm_____

City_____ State_____

Dependable

It's fully dependable over the complete range of welding. That's why those who *know* welding equipment choose the PREST-O-WELD W-111 Blowpipe. They know they can rely on it for smooth, economical performance on any job—from light sheet to thickest casting—because it's built to exacting standards by precision craftsmen.

They like the W-111 Blowpipe's sturdy build—its all 'round efficiency. They like its wide selection of 13 standard and 4 extra-long sizes of welding heads with individual mixers that assure exact gas mixtures for every job. And they like the way the W-111 stands up under hot and heavy work where other blowpipes quit.

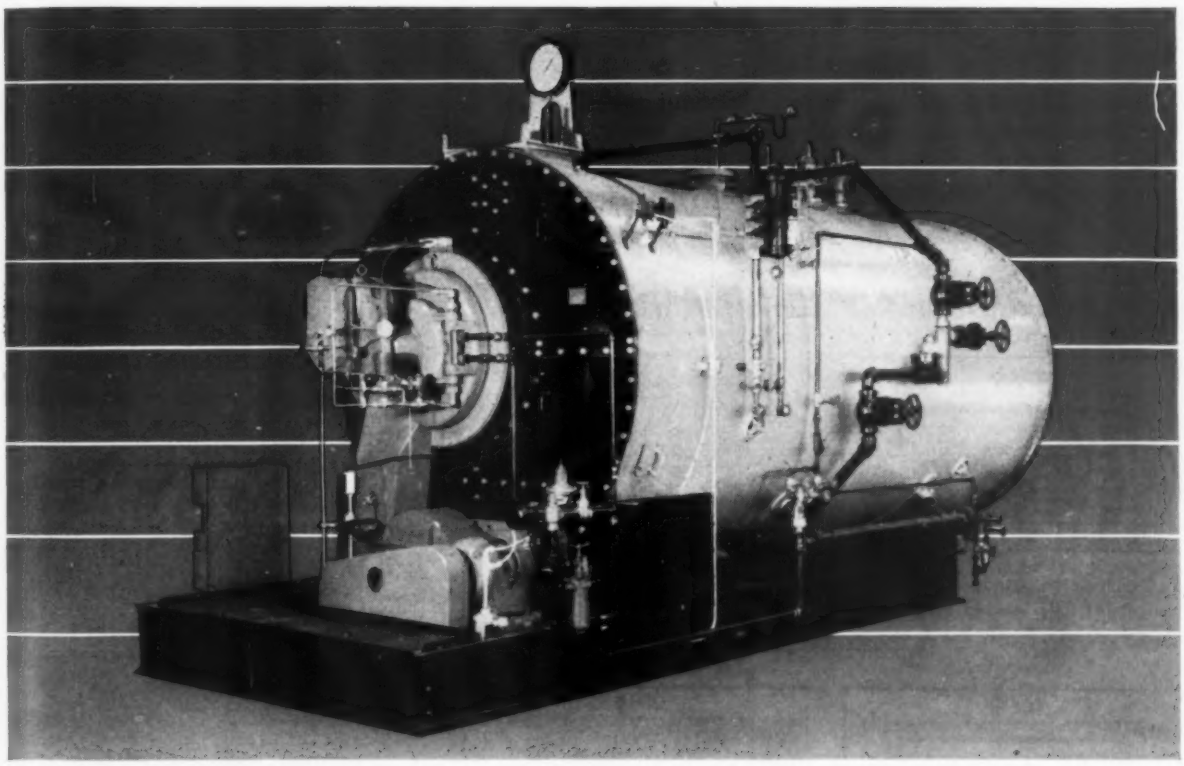
"Prest-O-Weld" is a trade-mark of Union Carbide and Carbon Corporation.

Order from your local Jobber

or write us for his name and address. The Linde Air Products Company, 30 East 42nd Street, New York 17, N. Y.

A NATION-WIDE NETWORK OF FACTORY-AUTHORIZED SERVICE

. . . Another Reason Why You Get A Greater Return From Your Investment In A Cleaver-Brooks Steam Boiler



Nothing is more important than dependable operation of your steam boiler — vital to such operation is proper maintenance and service.

Cleaver-Brooks steam boiler service facilities are national — through factory-trained and authorized service organizations. Service begins with starting of your new boiler. It is placed in operation and fully tested under load by Cleaver-Brooks service-representatives. Your operators are trained in operation, care and maintenance.

Burn the available fuel in your area — gas or oil — with equal efficiency: Through their high heat transfer Cleaver-Brooks boilers operate at a guaranteed efficiency of 80% from full load down to 30% of rating, burning gas, oil, or combination gas and oil. No high or costly stacks (a simple roof vent carries off combustion gases)—no special foundations needed. Fit low head-room areas — provide quick steaming, flexible operation to meet fluctuating loads — eliminate ash handling. Cleaver-Brooks boilers fully meet all codes — available in sizes 15 to 500 H.P. — 15 to 200 P.S.I. Write for new, just published catalog.

CLEAVER-BROOKS COMPANY
335 East Keefe Avenue, Milwaukee 12, Wisconsin

NEW —*The Cleaver-Brooks steam boiler Catalog—interesting—informative—beautifully illustrated. Write—on your business letterhead for your copy.*

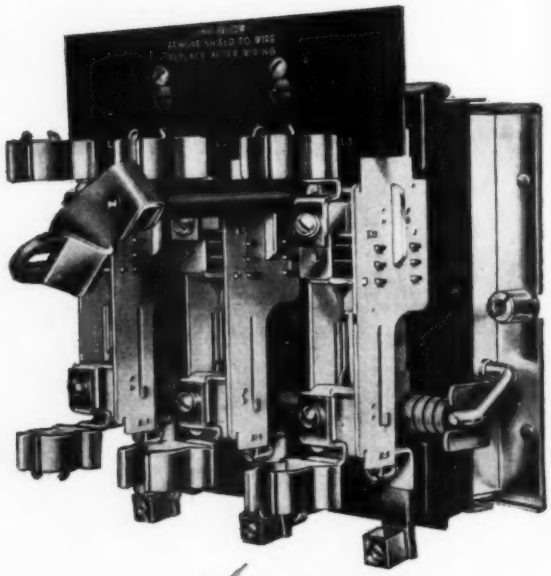
Cleaver-Brooks
STEAM BOILERS

NOW...an ALL-NEW Type A Safety Switch for modern high-capacity distribution systems...

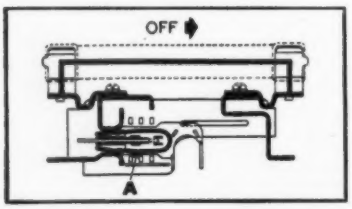
TRUMBULL'S HCI

HIGH CAPACITY INTERRUPTER

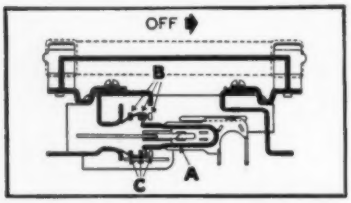
Unusually high interrupting capacity..."circuit-breaker" action breaks heavy loads quickly, safely. Extremely high momentary current capacity . . . withstands heavy short circuits without damage. 30-, 60-, 100-ampere sizes.



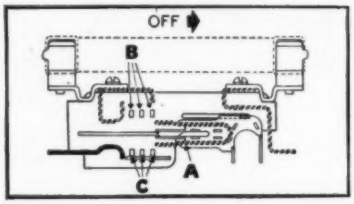
Here's How...
HCI's "Circuit-Breaker" Action Works



1. Switch closed. Spring-loaded sliding contact (A) fully inserted between stationary contacts. Heavy line is current.



2. Sliding contact being withdrawn. The two arcs repel each other, are drawn against grid pins (B) and (C), which break and cool them.



3. Contact fully withdrawn. Trumbull's unique "Circuit-Breaker" action has effectively extinguished the arcs.

CHECK THESE ADDITIONAL SPACE-SAVING, TROUBLE-PREVENTING, LIFE-LENGTHENING FEATURES

Center-front operation permits close ganging.

Front fusing allows compact box, yet gives ample wiring space.

No exposed live parts when switch is OFF and door is open.

Handle interlock.

Clear ON and OFF markings both inside and outside.

No dead center—roller-cam action (multiplying linkage design with powerful spring) throws switch to full OFF and ON.

Poles are self-contained switching units for easy replacement.

Silver-plated current-carrying parts prevent oxidation . . . give low-resistance contact.

Insulating parts made of linen melamene, light, strong, arc-resisting.

Enclosed operating mechanism (on 60- and 100-amp. sizes) prevents wire chafing.

Interior removable for wiring ease.

Underwriters' approval throughout.

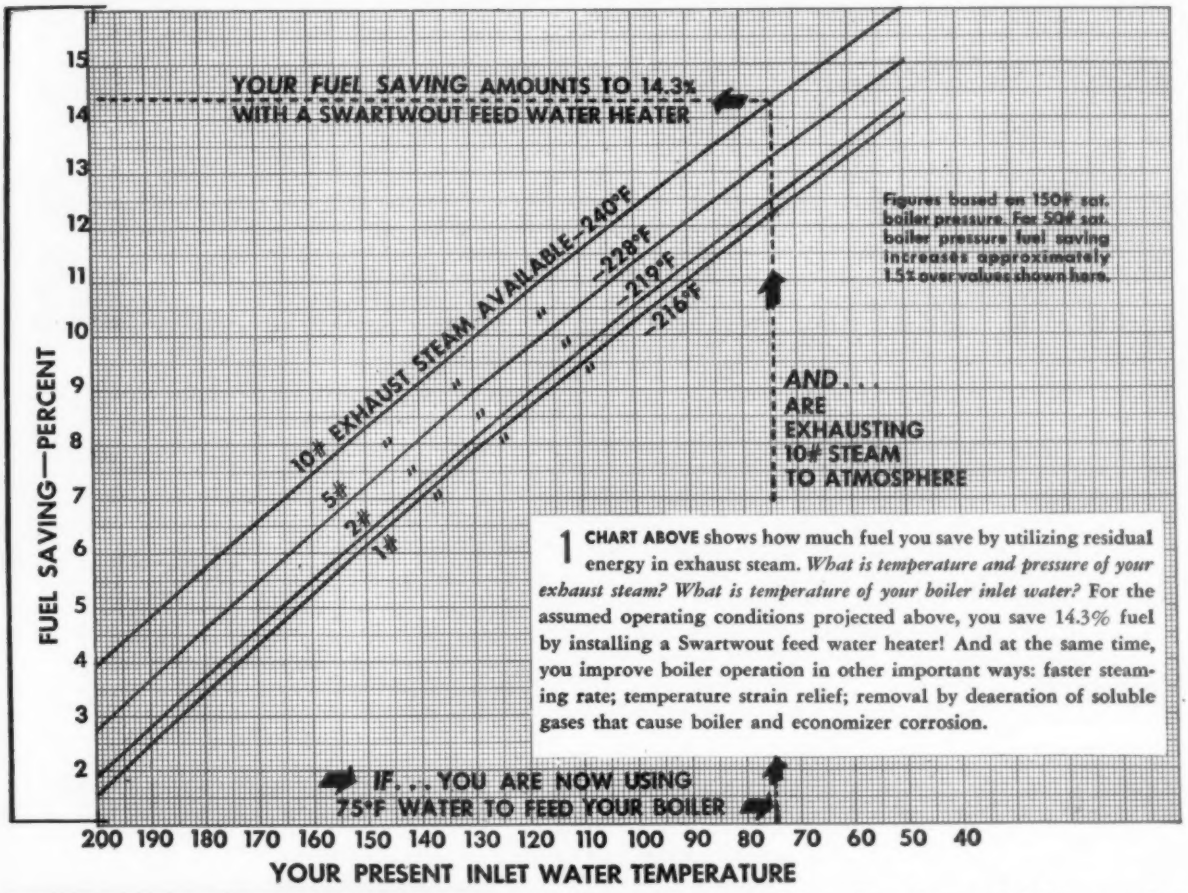
For more information about Trumbull's all-new HCI Safety Switch, write for your free copy of Bulletin TEC-10 today. THE TRUMBULL ELECTRIC MANUFACTURING COMPANY, Plainville, Connecticut.

Men Who Observe the Best Electrical Practice Make It a Practice to Use

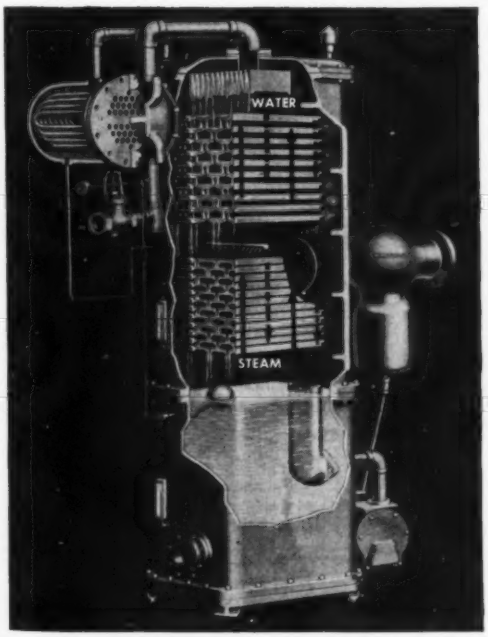
TRUMBULL (T) ELECTRIC

TRUMBULL'S TRAINLOAD OF NEW PRODUCTS

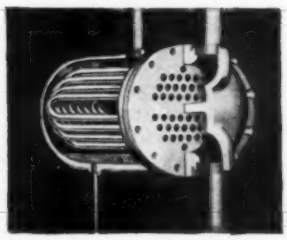
Use exhaust steam! Swartwout feed water heaters save 1% fuel for every 11° temperature rise


YOUR FUEL SAVING AMOUNTS TO 14.3% WITH A SWARTWOUT FEED WATER HEATER
10# EXHAUST STEAM AVAILABLE—240°F
5# " " —228°F
2# " " —219°F
1# " " —216°F
Figures based on 150# sat. boiler pressure. For 50# sat. boiler pressure fuel saving increases approximately 1.5% over values shown here.
AND . . . ARE EXHAUSTING 10# STEAM TO ATMOSPHERE
IF . . . YOU ARE NOW USING 75°F WATER TO FEED YOUR BOILER
FUEL SAVING—PERCENT
15 14 13 12 11 10 9 8 7 6 5 4 3 2
200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40
YOUR PRESENT INLET WATER TEMPERATURE

1 CHART ABOVE shows how much fuel you save by utilizing residual energy in exhaust steam. *What is temperature and pressure of your exhaust steam? What is temperature of your boiler inlet water?* For the assumed operating conditions projected above, you save 14.3% fuel by installing a Swartwout feed water heater! And at the same time, you improve boiler operation in other important ways: faster steaming rate; temperature strain relief; removal by deaeration of soluble gases that cause boiler and economizer corrosion.



2 COUNTERFLOW heating and deaerating, a feature of all Swartwout feed water heaters, assures efficient removal of contaminating gases. Just before dropping into storage section, feed water is in contact only with clean steam, thereby preventing reabsorption of oxygen. Through counterflow, last traces of oxygen are removed from feed water according to law of partial pressures of gases.



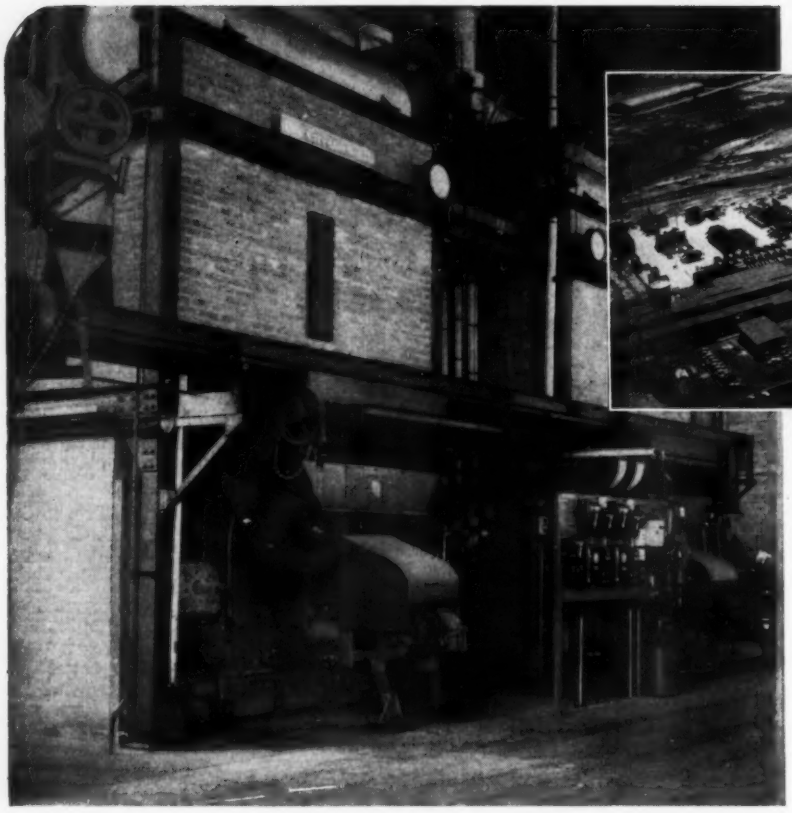
3 VENT CONDENSER is smaller in heaters utilizing counterflow principle. Because less steam does more work, a large condenser is totally unnecessary — important from the standpoint of maintenance economy. Swartwout makes a complete line of deaerating and open heaters —from 5,000 to 300,000 lbs. capacities.

A-2975

Swartwout

POWER PLANT EQUIPMENT

SEND FOR BULLETIN S-18-E • THE SWARTWOUT COMPANY, 18511 EUCLID AVENUE, CLEVELAND 12, OHIO



THE EUCLID ROAD MACHINERY COMPANY, one of the foremost manufacturers of heavy equipment for moving earth, rock, coal and ore

TRIES OIL—SWITCHES BACK TO CANTON STOKERS

for Economy and Better Power Service . . .

When The Euclid Road Machinery Company built its modern Chardon Road plant in Cleveland, Ohio, two Canton Stokers were installed to fire the boilers of the power plant.

Later, one of the stokers was replaced by an oil burner but costs were too high and results not always satisfactory. Accordingly, when a new power plant was designed for greater economy and better results, Canton Stokers were placed back on the job.

Like hundreds of users of Canton Stokers for power and heating, Euclid finds by experience that Canton-Stoker-fired coal is the most economical and flexible fuel to meet the fluctuating demands of power and heating service. Moreover, Canton Stoker users enjoy the advantages of long, trouble-free service with almost negligible maintenance. Canton Stokers are so ruggedly built that *the driving mechanism is guaranteed for five years.*

Canton Stoker Field Sales Engineers will be pleased to help you find the economical answer to your power and heating problems — without obligation, of course. Write, phone or wire Canton Stoker Corporation, **403** Andrew Place S. W., Canton 1, Ohio.

CANADIAN LICENSEES: VOLCANO, LTD., MONTREAL, QUE.

CANTON STOKERS

DURAFLEX WORMFEED
for loads up to 175 H.P.

LO-SET RAMFEED
for loads up to 350 H.P.

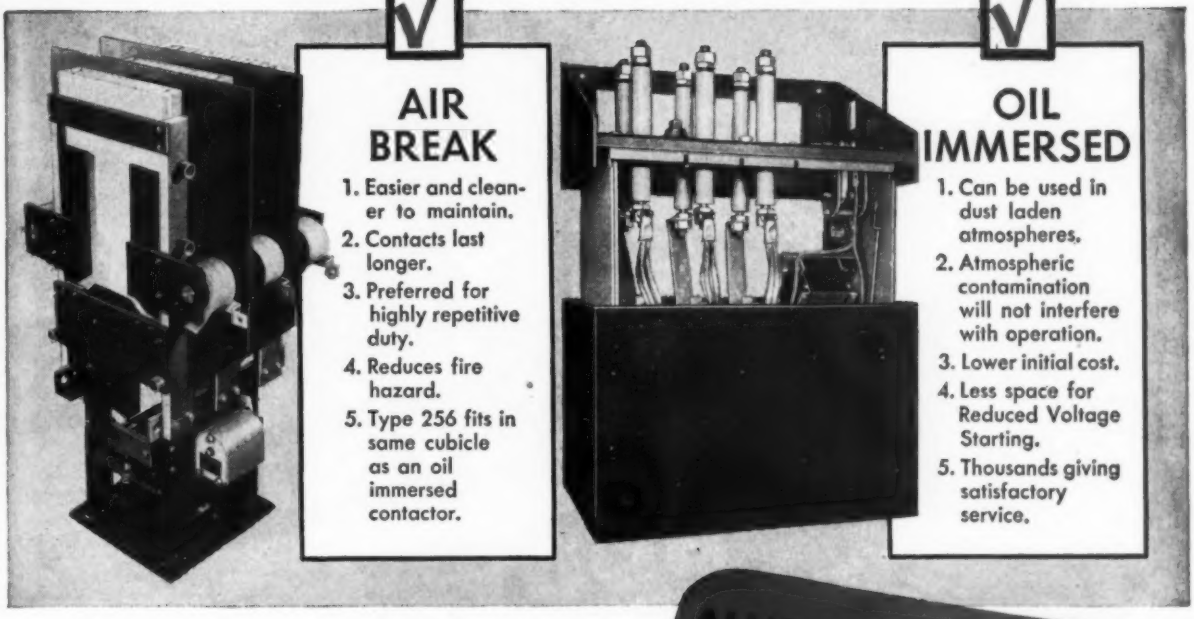
VULCAN RAMFEED
for loads up to 800 H.P.

Also

SYNCHRONIZED COMBUSTION CONTROL SYSTEMS
for all boilers

TURBO-AIRE JETS
for smoke abatement, firing efficiency

Which Contactor is Best for You?



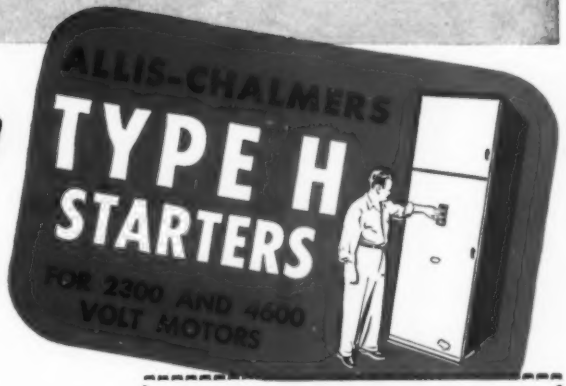
AIR BREAK

1. Easier and cleaner to maintain.
2. Contacts last longer.
3. Preferred for highly repetitive duty.
4. Reduces fire hazard.
5. Type 256 fits in same cubicle as an oil immersed contactor.

OIL IMMERSED

1. Can be used in dust laden atmospheres.
2. Atmospheric contamination will not interfere with operation.
3. Lower initial cost.
4. Less space for Reduced Voltage Starting.
5. Thousands giving satisfactory service.

You can get either in



OIL OR AIR — whichever contactor is best suited to your application can be built into Allis-Chalmers Type *H* Starters. Both are designed for ready access . . . built to give long life with low maintenance. And regardless of the contactor you select, all Allis-Chalmers Type *H* Starters give split-cycle short circuit protection through current limiting fuses.

You get *complete* protection in one attractive, easy to install steel cabinet. Segregated high voltage compartment, enclosed bus bars and safety door interlock protect personnel. Overload and time delay undervoltage devices are coordinated with the contactor to protect motor and equipment.

Choose the starter to fit your needs. For full or reduced-voltage starting, reversing or dynamic braking of squirrel-cage, wound rotor or synchronous motors . . . Allis-Chalmers Type *H* Starters will be your right answer. Call your nearby A-C representative or send coupon today.

ALLIS-CHALMERS

ALLIS-CHALMERS 948A SO. 70 ST.
MILWAUKEE, WIS.

Please send me more information on Allis-Chalmers Type *H* Starters. ☐ Include bulletin 14B7303 on Type 256 Air Break Contactor.

Name _____

Title _____

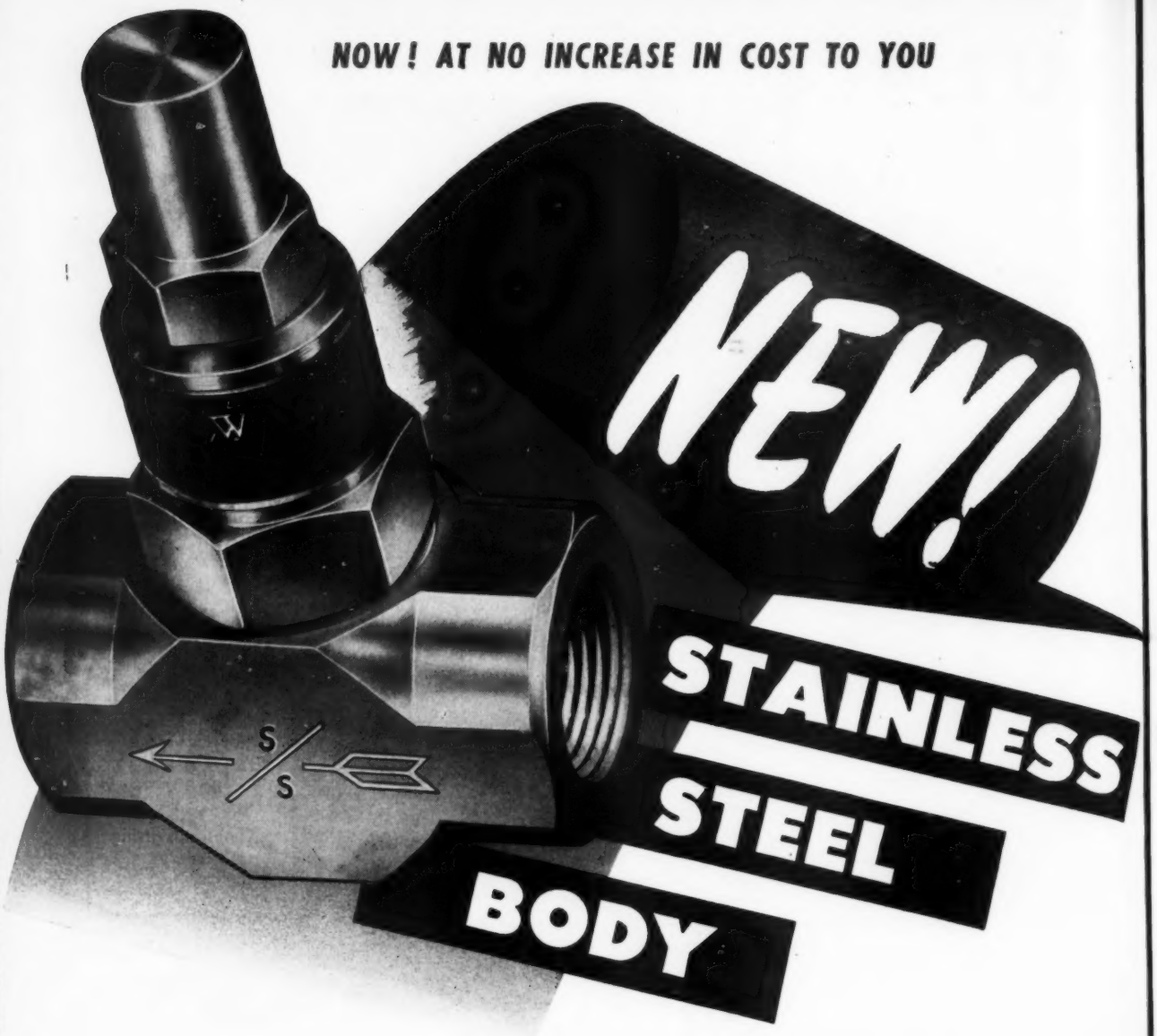
Company _____

Address _____

City _____ State _____

A-2926

NOW! AT NO INCREASE IN COST TO YOU



Makes a good steam trap better

Nearly 650,000 Yarway Impulse Steam Traps have already been installed—proof that they are doing a good job.

Now a *stainless steel* body makes this famous little trap even *better—at no increase in cost.*

Better in *wear*, better in *service*. Users will find Yarways require less maintenance than ever. All parts are wear-resistant, practically wear-proof. There is only one moving part, a small, stainless steel, heat-treated valve. Important, too—Yarway Impulse Traps are *suitable for all pressures up to specified maximum without change of valve or seat.*

Other popular advantages are *small size, light weight, easy installation* and *low cost.* Often it costs *less* to buy a new Yarway trap than to repair an old, ordinary trap.

In performance—ask any user. They all say Yarways are the traps that *get equipment hotter sooner and keep it hot!*

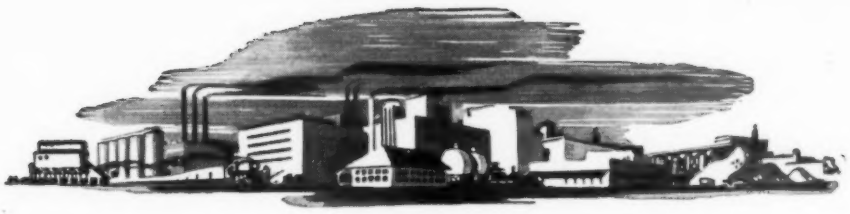
For better steam trap performance, try *new* stainless steel Yarways.

YARWAY IMPULSE STEAM TRAPS ARE SOLD BY OVER 200 DISTRIBUTORS. THERE IS ONE NEAR YOU.

Write for name and address.

YARNALL-WARING COMPANY
109 Mermaid Avenue, Philadelphia 18, Pa.

YARWAY IMPULSE STEAM TRAP



"We Added an Hour's Production Time Daily, *by Investing Just $2640!*"

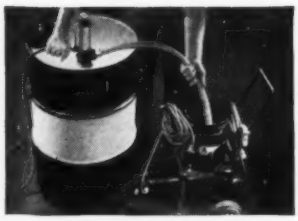
It happened in Philadelphia, in a plant* where ten machines with 560 bearings were being lubricated by old-fashioned methods that wasted valuable production time.

An Alemite Lubrication Engineer was consulted, to work with the plant engineers and help find a solution to this problem, an all-too-common one in industry today. A modern Alemite Centralized System was planned and installed, to lubricate all 560 bearings from a central point. Total cost—$2640. Lubrication time was cut from four man-hours to 10 minutes per week. A whole hour's production time was added to every working day, and the resulting added revenue paid for the entire project in just 66 days.

No matter what size or type of plant you operate, Alemite can show you dozens of ways to make worthwhile savings through more efficient handling of petroleum products. These are facts which you can readily confirm in your own time studies. Contact your local Alemite Industrial Distributor now. Or send for free booklet "11 Ways to Cut Production Costs." Simply attach coupon below to your letterhead. Alemite, Dept. M-30, 1850 Diversey Parkway, Chicago 14, Ill.

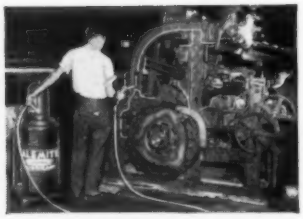
*Name on request

Alemite Cuts Costs 3 Ways



1. ***In Transferring Lubricants...*** by eliminating mess, expensive contamination—and cutting man hours 63% for every 100 pounds of lubricant transferred.

2. ***In Loading Grease Guns . . .*** by saving 3¾ man hours for every 100 pounds of lubricant loaded into hand guns.



3. ***In Applying Lubricants . . .*** by saving up to 23.9 man hours for every 100 pounds of lubricant applied to bearings.

ALEMITE

MEANS EVERYTHING FOR LUBRICATION

1. Methods 2. Lubricants 3. Equipment

Another Product of Stewart-Warner

FREE! New Booklet—
"11 Ways to Cut Production Costs"...
(simply attach to your letterhead)

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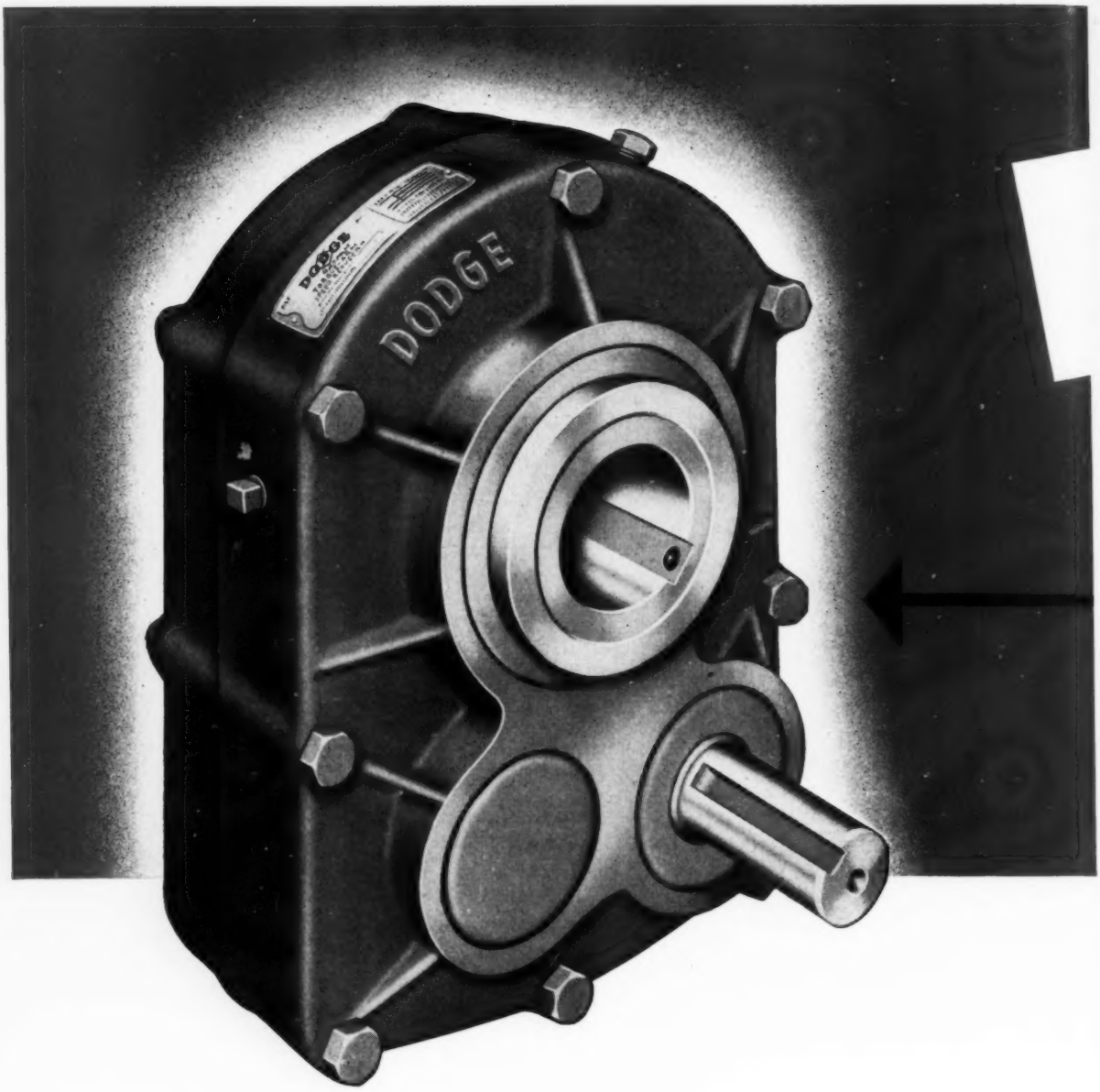
Please send me without charge or obligation your booklet "11 Ways to Cut Production Costs."

*Name*_____

*Company*_____

*City*_____ *State*_____



- Available from *stock,* with stock-product economy. Built in six sizes with capacities up to 25 H. P. Develops any output speed from 13 to 133 R. P. M. through the use of stock TAPER-LOCK sheaves as prescribed for the job.
- No special engineering required. No foundation to provide. No flexible couplings. No sliding base. No "lining-up" difficulties. No expensive installation.
- Reducer locks on the shaft-to-be-driven with a steel locking collar on *each side* of unit.
- Unit is driven through any V-Belt Drive. This absorbs shock loads. Speeds can be varied by simple change of sheave. Interchangeable bushings adapt shaft sleeve to different shaft sizes, making application to other machines practical and easy.
- Torque arm, fastened to floor or any fixed object, anchors the reducer unit. Turnbuckle in torque arm provides fast and accurate adjustment of belt tension.
- Extremely compact, light. (Size No. 1 weighs only 35 pounds.) Extremely rugged. Cast iron housing. Double reduction train of helical steel gears. Shaved for *quiet* operation—heat treated for *long* life. Generous capacity deep groove ball bearings. Neoprene seals.
- Backstop available when required. Simple and positive. Easily installed on input shaft. Sealed from dust and dirt inside the reducer case.
- The TORQUE-ARM SPEED REDUCER is a *DODGE* product—which means *fine* engineering, *quality* manufacture. Get all the facts. *WRITE* for bulletin with selection tables.

NEW!

TORQUE-ARM SPEED REDUCER

SAVES MONEY!

The Dodge TORQUE-ARM SPEED REDUCER is a new tool for the mechanical transmission of power, so practical in design, so effective in operation, so low in cost, that it promises to benefit industry as extensively as the famous Dodge-Timken Bearing, the Dodge Rolling Grip Clutch, the Dodge Taper-Lock Sheave and other Dodge "firsts."

If you use conveyors of any kind, bucket elevators, agitators, mixers, feeders, processors or similar machinery—here is your opportunity to improve your drives, reduce maintenance and make substantial savings on equipment and installation.

See your local Dodge Distributor. Simply give him your horsepower requirement and the desired speed and size of the shaft to be driven. He will furnish you *from stock* this complete speed reducer package, to fit your job accurately, economically.

WRITE to us for Bulletin No. A470 with details, specifications and easy-to-use selection tables.

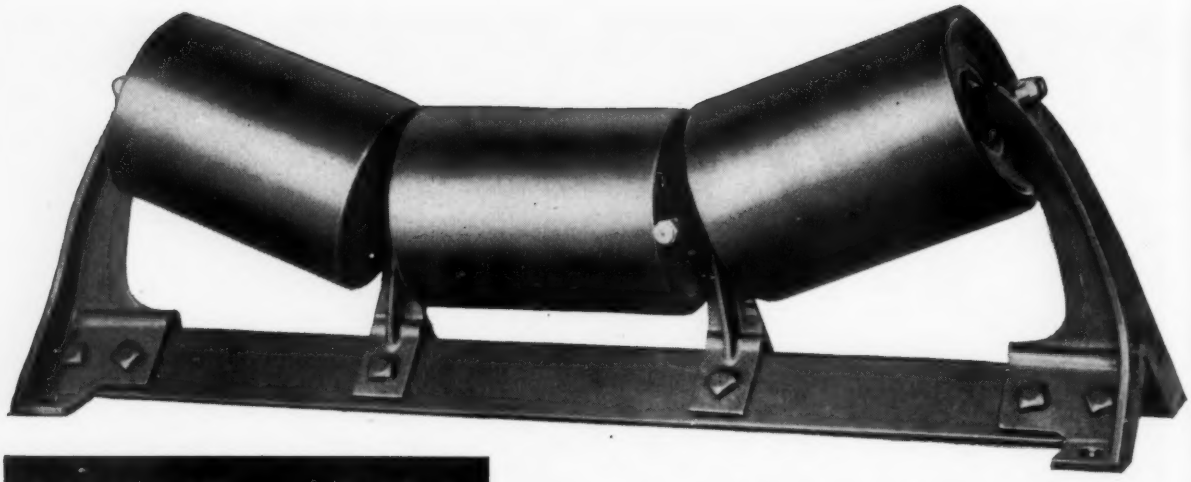
DODGE MANUFACTURING CORPORATION • 700 UNION STREET, MISHAWAKA, INDIANA

CALL THE TRANSMISSIONEER, your local Dodge Distributor, for information on new ways to improve machine performance, cut costs. Look for his name under "Power Transmission Equipment" in your classified telephone book.

DODGE

of Mishawaka, Ind.

FIRST IN POWER TRANSMISSION MACHINERY



GIVE IT A RIDE— ON JEFFREY BELT IDLERS

Costs must be cut. No question about that . . . and no question about the economy of Jeffrey Belt Conveyors when small or large quantities of material must be handled. We can furnish them by the rod, or mile, just as the job requires. We know how to provide for reliability under tough conditions, handling of peak loads, low investment, high salvage and other things which are problems peculiar to engineering.

Hence, we say, "Give That Material A Ride on Jeffrey Idlers." They are the backbone of the belt conveyor . . . have been the choice of smart operators on thousands of jobs. They are built to take day-after-day punishment . . . have that reserve strength and durability that count for many years of satisfactory, efficient trouble-free service.

Whether yardage looms large in the estimate, or small capacity is desired, Jeffrey engineers are skilled in the application of material handling to most any job. We would like to talk things over—constructively.

Catalog No. 785 Tells All

Self-aligning, Troughing-type Belt Idler

Pivotly mounted on a supporting cross member, guide rollers are mounted on arms and extend at right angles to idler. Need only to be spaced about 20 to 50 feet apart to keep belt in perfect alignment. Will not damage belt.

Pivoted-type Return Idler

Used for both troughing and flat belt conveyors. Of the self-aligning, two-pulley type. Also standard return rolls pivotly mounted in ball bearings on supporting cross member. Write for full details about Jeffrey Idlers for either troughing or flat belt service.

THE JEFFREY MANUFACTURING COMPANY

Established 1877

814 North Fourth St., Columbus 16, Ohio

Complete Line of Material Handling, Processing and Mining Equipment

JM

Baltimore 2	Chicago 1	Detroit 13	Jacksonville 2	Pittsburgh 22
Birmingham 3	Cincinnati 2	Harlan	Milwaukee 2	St. Louis 1
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STOP RUST!

YOU can STOP RUST . . . PREVENT RUST...on *any* rustable metal surface with RUST-OLEUM. Every day, rust eats away on your metal tanks, buildings, fences, stairs...everything metal inside and outside your plant. Yet, rust *can* be stopped and protection given economically with RUST-OLEUM.

For more than a quarter of a century RUST-OLEUM has been *proved* under severe conditions of weather, fumes, salt air, salt spray, and other rust producing conditions. Railroads, shipyards, builders, refiners...nationally known users* in almost every field of industry...have found RUST-OLEUM the economical way to stop rust and prevent further rust. Architects, builders, engineers, maintenance men now specify RUST-OLEUM for primer, "shop coat", and finish coats.

RUST-OLEUM adds extra life to metal buildings, equipment and other metal surfaces and can be applied over already rusted surfaces without extensive surface preparation. Yet, RUST-OLEUM costs no more than most quality materials.

RUST-OLEUM not only protects — it beautifies as well! RUST-OLEUM is available in a large selection of colors including aluminum and white. It spreads evenly...and dries free of brushmarks in 4 to 12 hours, depending on conditions, to a tough, pliable film that protects against rust.

Be sure you get *only* genuine RUST-OLEUM for positive protection against rust! Specify RUST-OLEUM to your contractor or architect on any new construction, remodeling or maintenance work.

RUST-OLEUM is stocked and sold by leading industrial distributors in all principal cities of the United States and Canada. See Sweets for complete catalog and nearest source of supply, or write us direct for complete information.

**Names on request*

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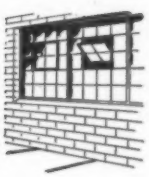
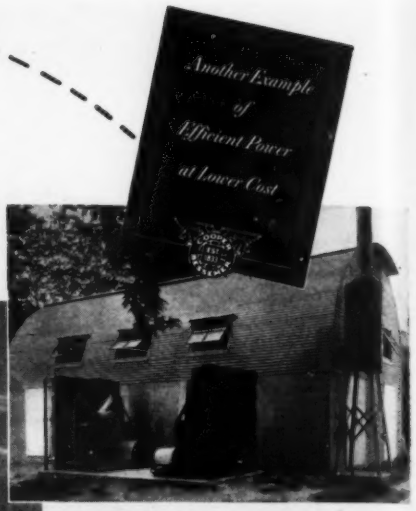
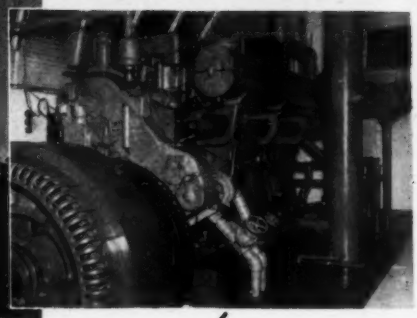


ASHORE...AFLOAT...





it's Cooper-Bessemer 100%

for 2-way savings at Reedville Oil & Guano Co.

This company's fish reduction plant, where 50 tons of Menhaden can be processed per hour, is now completely powered by its own diesel-electric power plant. The prime mover is a Cooper-Bessemer diesel, preferred largely because of the outstanding performance of Cooper-Bessemer marine diesels in the company's four large Menhaden boats shown above.

The fact that each of these boats was converted from steam to Cooper-Bessemer diesel propulsion over a period of years speaks for itself — evidences the high efficiency and over-all operating economy of these lusty engines. Similarly, the stationary Cooper-Bessemer in shore service will soon pay for itself in reduced power costs.

For low-cost diesel power at its best, stationary, marine or locomotive, you'll be wise to check with Cooper-Bessemer.

Above, left: "David K. Phillips", "Margaret", "Alden S. Swan" and "William S. Brusstar", 125' to 130' over-all, all repowered from 1944 to 1947 with Cooper-Bessemer direct-reversing diesels ranging from 515 to 730 bhp.

Above, right: Exterior and interior view of diesel-electric plant, powered by a supercharged Cooper-Bessemer 865 hp JS-6 diesel driving a 600 kw Elliot generator. Radiators adjacent to power house cool engine jacket water and water for lube oil cooler.

The Cooper-Bessemer Corporation

MOUNT VERNON, OHIO — GROVE CITY, PENNA.

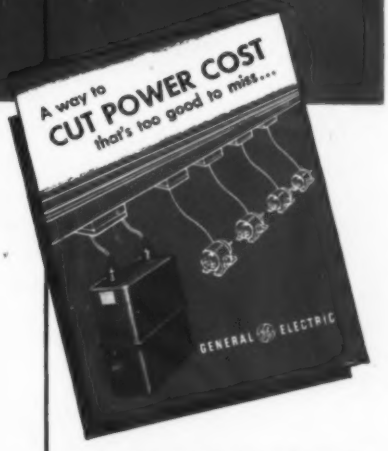
New York City Washington, D. C. Bradford, Pa. Chicago, Ill. San Francisco, Calif. Houston, Dallas, Greggton, Pampa and Odessa, Texas Seattle, Wash. Tulsa, Okla. Shreveport, La. St. Louis, Mo. Los Angeles, Calif. Caracas, Venezuela Gloucester, Mass. Calmes Engineering Co., New Orleans, La.

here's a "bank" that pays 633% yearly interest !!

The Old Dominion Iron and Steel Co. of Richmond, manufacturers of welded steel tanks, were in for a surprise. They decided to boost their power factor from 65% to 85% by installing a bank of 15 G-E capacitors—counting on power company bonuses for this higher power factor to pay for the installation in three years.

Faster and better welds provided the real pay-off. By reducing the voltage drop caused by feeder circuit reactance, the capacitors now pay for themselves every two months in increased production. Total return —633% a year!

If your production is slowing down for this reason, G-E capacitors may be your answer, too. If you have a power-factor or kva-demand clause in your power contract, they may give you substantial savings in power costs. They can also provide relief for overloaded feeders, transformers or switchgear. Better check with your nearest G-E representative today.



A NEW BOOKLET explains how capacitors work and gives specific data to show you what you may expect from them. Write today for Bulletin GEA-5167. Apparatus Dept., General Electric Co., Schenectady 5, N. Y.

For other power distribution ideas that will save you money, ask your electric utility to show you the full-color slide-film, "Modern Industrial Power Distribution," or contact your G-E representative.

GENERAL ELECTRIC

get ALL the dust EVERYWHERE with INVINCIBLE VACUUM CLEANERS

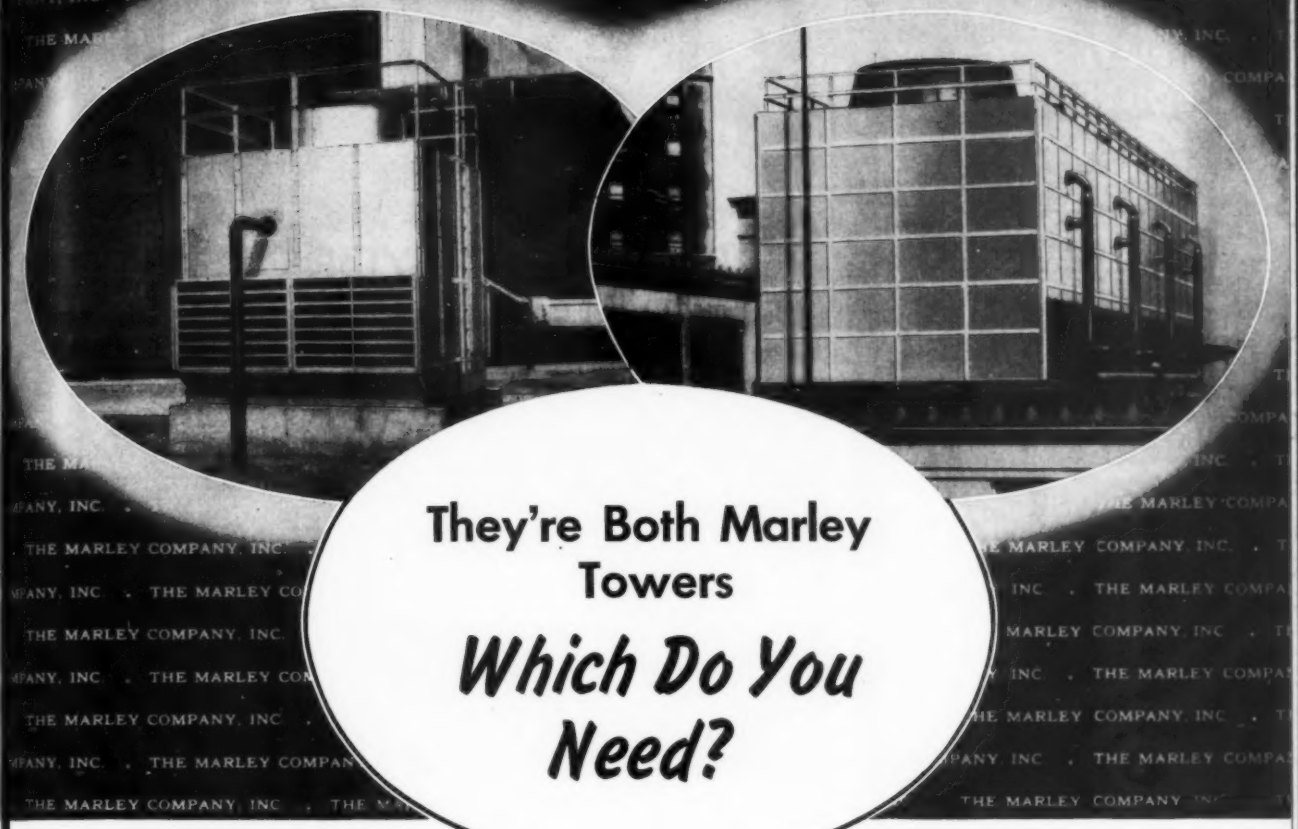
LIGHT PORTABLE—1½ H.P. —Complete and positive separation precedes the vacuum producer.

Thorough removal of industrial dust, dirt and litter, in less time, with less labor (and therefore at less cost) is achieved by Invincible Vacuum Cleaners. Even hard-to-reach spots are readily cleaned by these rugged machines and their handy attachment tools. Such complete cleaning insures better working conditions for your men, and less "dust-damage" to your equipment or product. That is why Invincibles in industry quickly pay for themselves.

INVINCIBLE
Vacuum Cleaner Mfg. Co.
DOVER, OHIO

SEND FOR BOOKLET— It tells—

- . . . About the 100,000 Invincibles now in service
- . . . Why Invincibles cut costs in every industry
- . . . How Invincibles clean every spot in the plant
- . . . About the many materials reclaimed or removed



They're Both Marley Towers

Which Do You Need?

YOU want a cooling tower that will handle your water cooling job effectively at the least possible cost!

But, do you know which cooling tower will do it?

That's where Marley "know-how" fits into your picture. You have a water cooling job to do. There's a Marley designed and Marley built cooling tower to meet every water cooling need. Marley trained Application Engineers, working with you from the blue-print stage on, will help you get more for your money and assure complete, lasting satisfaction.

Shown above are two of the many Marley cooling towers from which Marley engineers can make a selection to fit your need:

The **VAIRFLO** (left) a medium capacity cooling tower with extra quality features at no extra cost. Vairflo extras include a balanced spray system with patented Marley low pressure nozzles . . . totally enclosed motor . . . grease packed ball bearings in enclosed bearing housing . . . lifetime nail-less filling . . . filling that is easily removed and installed . . . complete basin fixtures . . . Marley-designed cooling tower fan . . . multiple cells if desired . . . extra heavy framing and casing to give unusually long service. The Vairflo sets a new standard for air conditioning and refrigeration service. Available in wood or steel. Bulletin V-50.

The **CONVENTIONAL** (right) with a model to meet all heavy duty water cooling requirements. Only Marley Conventional towers offer all these features . . . rigid fan cylinders . . . cast aluminum or stainless steel fans . . . motors propery located outside the fan cylinder . . . positive drive action . . . drift eliminators independent of the distribution system . . . spray nozzle distribution . . . nail-less filling . . . independent louver posts . . . exclusive Marley mechanical equipment. Available in wood or steel. Asbestos board casing if desired. Bulletin C-50.

For guaranteed performance at lowest possible cost, ask a Marley Application Engineer to study your cooling requirements with you, from the blue-print stage on, and to give you a fair and impartial recommendation for the type of equipment that best meets your need. There's no cost nor obligation.

MAIL THIS COUPON TODAY

The Marley Company, Inc., Kansas City 15, Kansas

☐ Please send me, FREE, your latest illustrated folders entitled, "What's Your Cooling Tower I.Q.?" I'm particularly interested in Cooling Tower Maintenance, Operation, Specifications, Testing, Water Treatment, Water Distribution.

☐ Have a Marley Application Engineer call to discuss our water cooling problem.

IP-3

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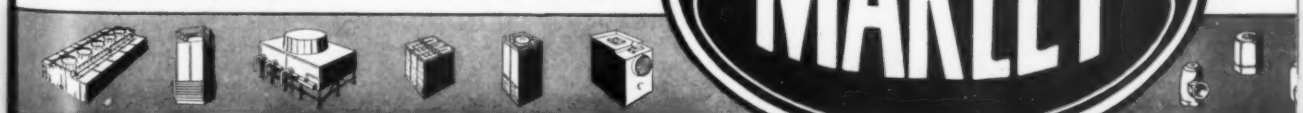
MARLEY



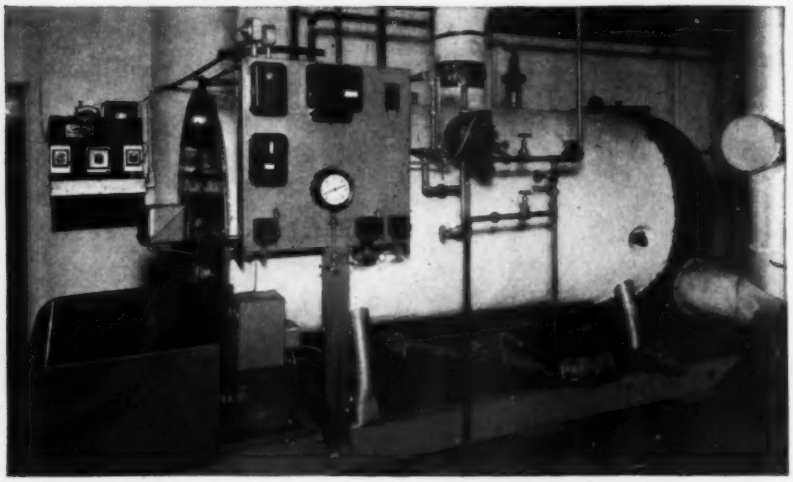
Double-Flow Vairflo DriCooler Natural Draft Counter-Flow Aquatower Spray Nozzles

STEAM-PAK

YORK 4S POWER

GENERATOR

A PRODUCT OF YORK-SHIPLEY



FUEL AND LABOR SAVINGS . . . "We consider the installation of the York Steam-Pak Generator one of the finest improvements ever made to our building. The saving in fuel and the saving in cost of labor is very noticeable. It is by a large margin more efficient than our coal stoker unit that we operated for several years and which we were always pleased with." Jonas Shure, Treasurer, Wm. H. Bradford Co., Boston.

SUBSTANTIAL SAVINGS

result from

- "Steam-Pak" efficient three-pass boiler construction.
- "Steam-Pak" automatic operation with varying loads.
- "Steam-Pak" rapid steam production.

PLUS *iris shutter* precise metering and rapid mixing of air and fuel in "Steam-Pak" burners — see Iris Shutter explanation at left.

"Steam-Pak" Generators are built in capacities from 15 h.p. up, for low or high pressure steam or hot water, for light or heavy oil, combination gas and oil, or straight gas. Ask for Bulletin No. 37-43. See your nearest York-Shipley dealer, or write, 'phone or wire

YORK-SHIPLEY

INDUSTRIAL DIVISION

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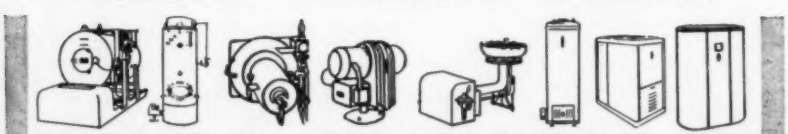
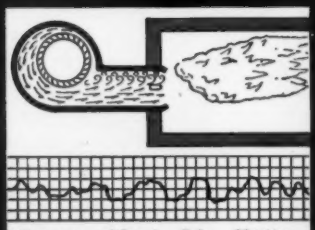


Gas and Oil Steam-Pak Generators | Gas and Oil Vertical Boilers | Rotary Industrial Oil Burners | Oil-Fired Conversion Burners | Gas-Fired Conversion Burners | Oil and Gas Water Heaters | Oil and Gas Winter Air Conditioners | Oil and Gas Tubeless Boiler Units

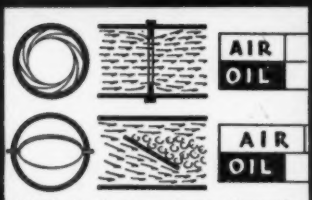
YORK 4S POWER INDUSTRIAL DIVISION — YORK YA HEAT RESIDENTIAL DIVISION

WITH *Iris Shutter* WATCH DOG OF BOILER EFFICIENCY

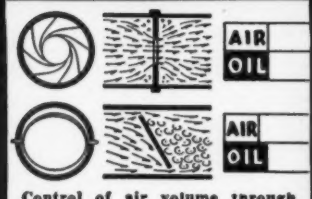
Above is pictured a typical burner WITH Iris Shutter control. Graph and flame illustration show the even flame and practically perfect control of air through your entire range.



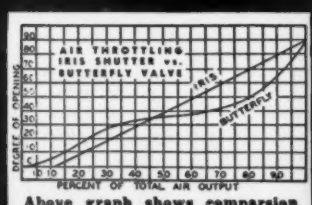
Burner without Iris Shutter shows air turbulance and uneven flame with fluxuating air volume indicating poor control.



Control of air volume through Iris Shutter versus butter-fly valve at 60% angle of opening.



Control of air volume through Iris Shutter versus butter-fly valve at 30% angle of opening. Note difference in volume control of air and oil.



Above graph shows comparsion between Iris Shutter and butterfly valves normally used in oil or gas burners. Note the perfect control with Iris Shutter.

Looking for Low-Cost Steam Production?

GRAHAM COAL

These three trade-marked coals are consistently winning enviable reputations as dependable guides to high efficiency at surprisingly low cost. Test the one our engineer recommends for your plant. See for yourself that one of these famous precision coals will assure more profitable operations.

GRAHAM Coal . . . BROWDER Coal . . . POWERHOUSE Coal . . . are designed specifically for industrial use. Produced in Western Kentucky by the most modern methods known to the industry, all three have proved to be dependable, low-cost power producers.

BROWDER COAL

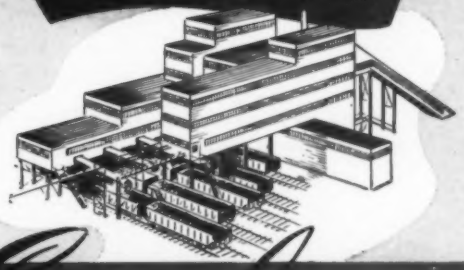
POWERHOUSE COAL

Big steady production and tremendous reserves assure an ample supply for years to come. The result of a test in your plant is likely to show the way to lower steam costs.

Specialized Service

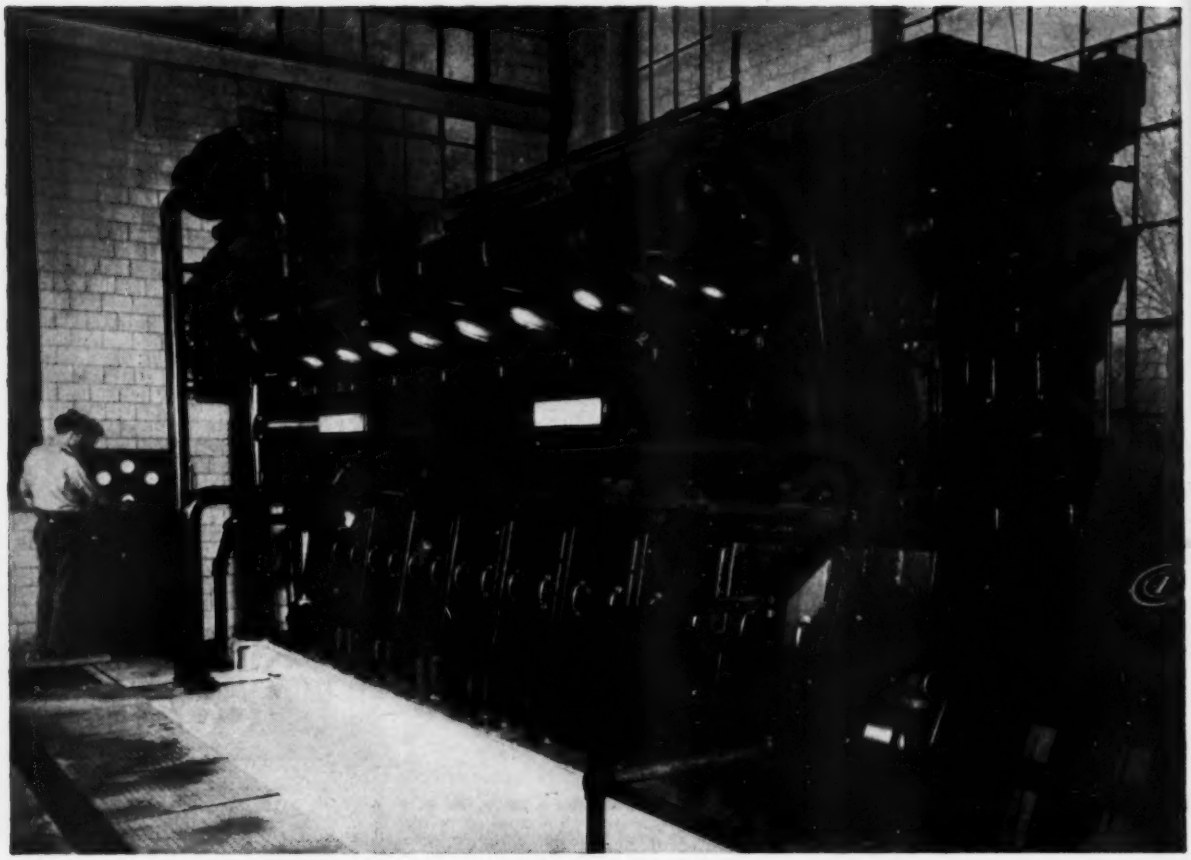
Our staff of fuel engineers is always available for counsel right in your plant. Only Southern can provide you this specialized service backed by 53 years experience in the coal business PLUS a studied concentration on industrial coals. Write or telephone our nearest office.

from One of the Most Highly Developed Coal Fields in the World! Scientifically Prepared



Southern Coal Company, Inc.

SOUTHERN COAL COMPANY INC.



FROM RED TO BLACK IN A HURRY

● Soaring costs and rising peak demands caused an Ohio generating plant to operate in the red. The management decided to do something about it—and they did.

They looked over the engine field . . . bought a supercharged Superior Diesel . . . and put it to work. After installation, over-all plant capacity was stepped-up almost 17% per gallon of fuel oil. This Model 80 Superior Engine also produced more BHP per gallon of lube oil . . . more than doubling the economy experienced in previous operations. The profit and loss statement changed from red to over $34,000 in the black in just ten months.

If you are looking for ways to cut power costs, chances are that a Superior representative can supply the answer. Why not have him explain how Superior pushes operating costs down? Or, if you prefer, write for our fully illustrated, 20-page booklet.

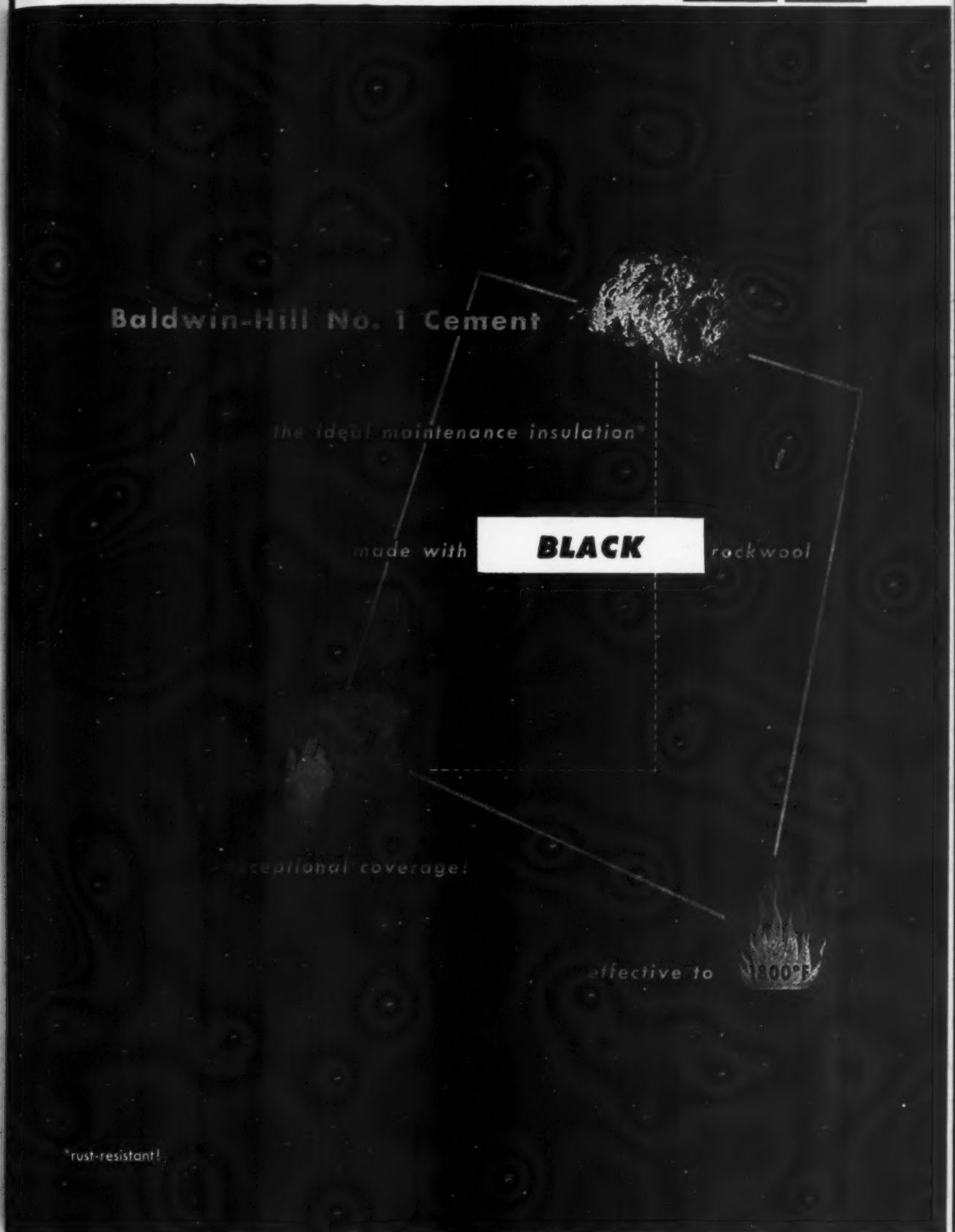
THE NATIONAL SUPPLY COMPANY
SUPERIOR ENGINE DIVISION
Plant and General Sales Office: Springfield, Ohio

THE NATIONAL NSCO SUPPLY COMPANY

Superior DIESELS

Locomotive · Marine · Oil Field · Stationary

"EVERY WORKING DAY OF HEAT LOSS *ANYWHERE* IN YOUR PLANT IS WORKING CAPITAL LOST"



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Name_____ Position_____

Firm_____

Address_____

"We Saved Valuable Space . . . and reduced the cost of a new panelboard . . . when we installed 400 amp. Fusetron dual-element Fuses instead of 600 amp. ordinary fuses."

"After we were awarded the contract, for electrical work in a new ice plant, we discovered that the power distribution panel was far too large for the space allotted to it. This panel was to accommodate two 60 horsepower motors, plus several smaller ones.

"There was only one convenient location, so we refigured the panel size based on using Fusetron Dual-Element Fuses. We reduced the panel sections for the 60 H.P. motors from 600 amp. fuses to 400 amp. Fusetron fuses and reduced the sizes for the other motors in proportion.

"The panel fitted the space easily. In addition to saving the necessary space, the cost of the panel was reduced considerably."

E. H. Brown, Vice President
Sanborn Electric Company
Indianapolis, Indiana

FUSETRON FUSES GIVE 10 POINT PROTECTION

FUSETRON

TRUSTWORTHY NAMES IN ELECTRICAL PROTECTION

BUSS

1. Protect against short-circuits.
2. Protect against needless blows caused by harmless overloads.
3. Protect against needless blows caused by excessive heating — lesser resistance results in much cooler operation.
4. Provide thermal protection — for panels and switches against damage from heating due to poor contact.
5. Protect motors against burnout from overloading.
6. Protect motors against burnout due to single phasing.
7. Give DOUBLE burnout protection to large motors — without extra cost.
8. Make protection of small motors simple and inexpensive.
9. Protect against waste of space and money — permit use of proper size switches and panels.
10. Protect coils, transformers and solenoids against burnout.

Fusetron DUAL-ELEMENT Fuses

Give All-Purpose Protection

because . . .

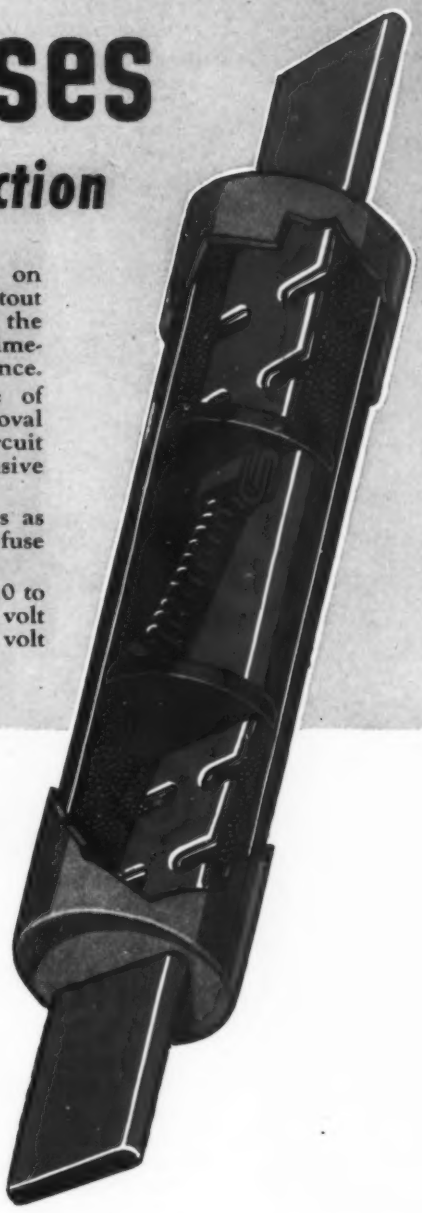
The fuse link element opens on short-circuit — the thermal cutout element protects on overloads — the result, a fuse with tremendous time-lag and much less electrical resistance.

They have the same degree of Underwriters' Laboratories approval for both motor-running and circuit protection as the most expensive devices made.

Made to the same dimensions as ordinary fuses — fit all standard fuse holders.

Obtainable in all sizes from 1/10 to 600 ampere, both 250 and 600 volt types. Also in plug types for 125 volt circuits.

Their cost is surprisingly low.



DON'T RISK LOSSES

One needless shutdown . . .

One lost motor . . .

One destroyed switch or panel . . .

May cost you far more than replacing every ordinary fuse with a FUSETRON dual-element fuse

MAIL THE COUPON NOW for complete information about Fusetron Fuses and their 10 point all-purpose protection

FUSETRON is a trade mark of the Bussmann Mfg. Co., Division of McGraw Electric Co.

Bussmann Mfg. Co., University at Jefferson
St. Louis 7, Mo. (Division of McGraw Electric Co.)

Please send me complete facts about FUSETRON Dual-Element FUSES.

Name.....

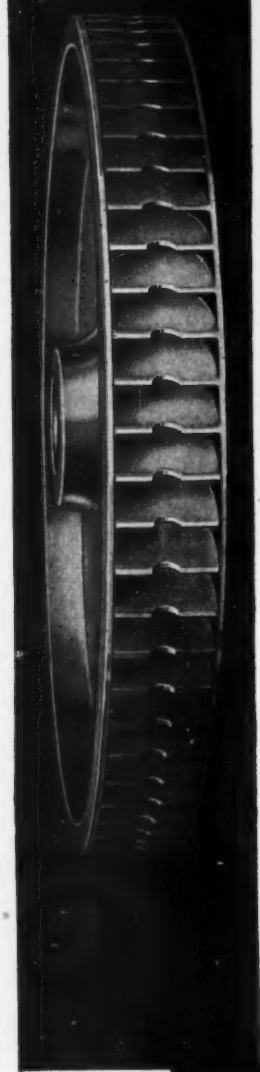
Title.....

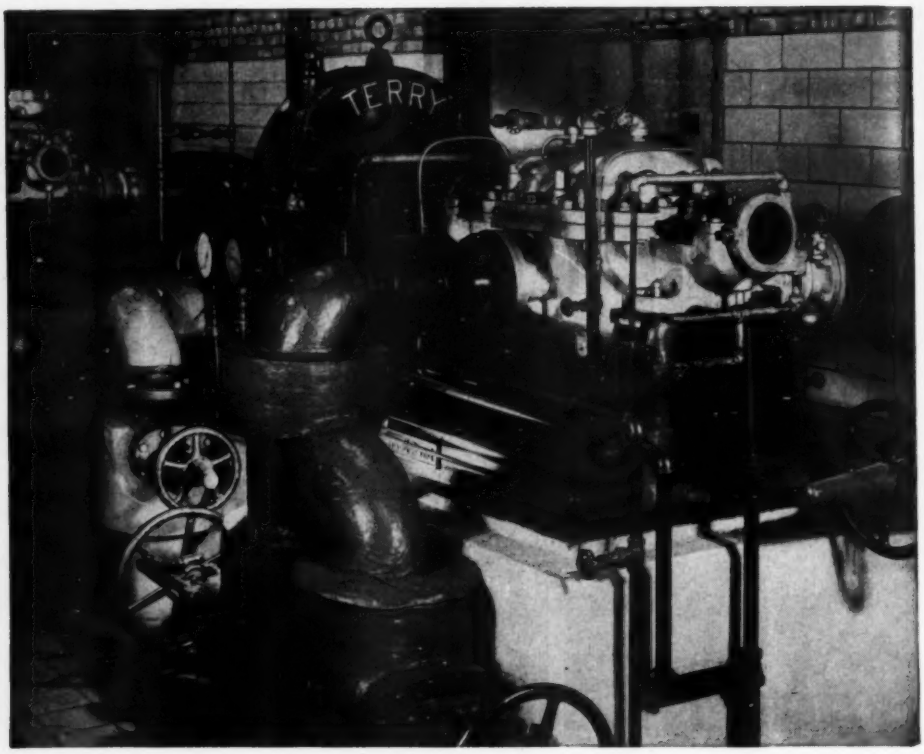
Company.....

Address.....

City & Zone.....State.....350

TERRY





110hp Feed Pump Turbine with Large Safe Clearances

The blades of this turbine are milled out of a one-piece forged-steel wheel with generous clearance both radially and axially. The side clearance is very large — one inch — and the blades are protected by a projecting rim on each side of the wheel. It is therefore impossible for the blades to foul and end play can do no damage to the turbine.

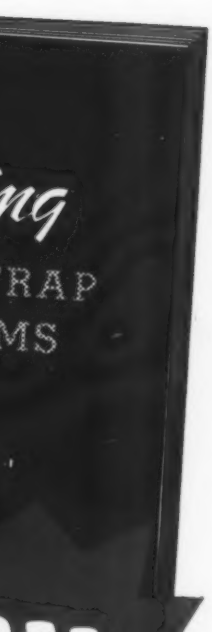
These are but a few of the features that make the Terry Solid-Wheel Turbine such a dependable driver. A bulletin giving other interesting facts about this turbine will be sent upon request.

T 1179

THE TERRY STEAM TURBINE COMPANY
TERRY SQUARE, HARTFORD, CONN.

ALL YOUR
QUESTIONS ANSWERED
about correct steam trapping

Here's a book that is especially prepared to answer all your questions about correct trapping of steam lines. Filled with helpful reference data, "Solving Steam Trap Problems" saves your time and money by giving you easy-to-follow formulas for proper trap selection. This book also contains many helpful hints on how to keep equipment at top efficiency by removing all condensate and air, as well as how to install and service traps. This valuable book is yours without cost. Simply attach coupon to your business letterhead and mail.



FREE
MAIL COUPON BELOW

HOW CAN I SELECT THE RIGHT TRAP FOR ANY INSTALLATION?

This 36-page book makes it easy to specify the correct steam trap. You'll save time and money by being able to determine the right trap for any installation in just a matter of minutes.

HOW MANY FITTINGS CAN I SAVE PER INSTALLATION?

It is no longer necessary to use three elbows and four nipples for the average steam trap installation. "Solving Steam Trap Problems" shows how to install a trap with a single fitting, saving 60 minutes of installation time.

WHY IS IT IMPORTANT TO TRAP UNIT HEATERS?

Learn how to get maximum heat from unit heaters! The heat delivery of a unit heater depends, among other things, on how completely the steam compartment is filled with dry hot steam. The correct method of trapping unit heaters to obtain maximum efficiency is fully explained.

WHAT IS FLASH STEAM?

Flash steam is frequently mistaken for live steam and a steam trap condemned when it is still satisfactory. You'll find a complete explanation of flash steam and how to distinguish from live steam.

ALSO HOW CAN I DETERMINE THE RIGHT TRAP FOR

• Pipe Coils and Heating Surfaces in Still Air • Fan System Heating Surfaces • Steam Jacketed Kettles • Autoclaves • Submerged Surfaces • Hospital Equipment • Kitchen Equipment • Laundry and Dry Cleaning Equipment • and many others.

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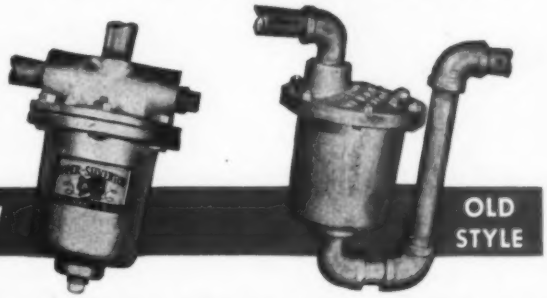

Save Money With SUPER-SILVERTOPS

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Gentlemen: Please send without obligation your book "Solving Steam Trap Problems."

Name .....

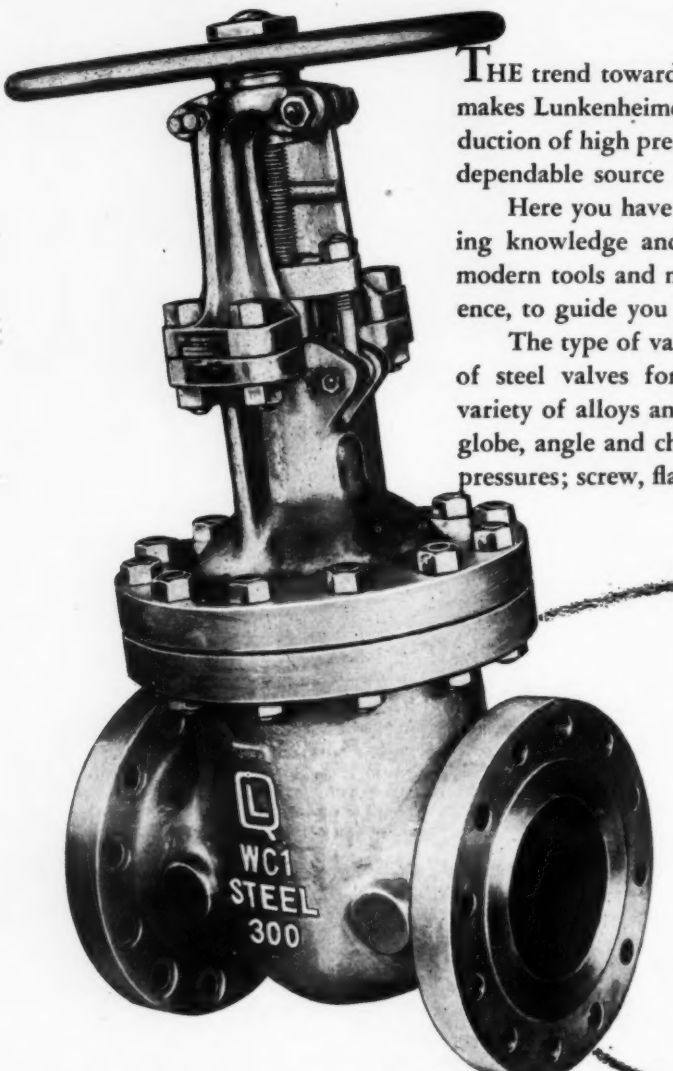
Address .....

City ..... *State* .....

In Canada: Bawden Machine Co., Toronto

FOR *Steel Valves* YOU CAN'T GO WRONG ON LUNKENHEIMER

This mark on steel valves is your assurance of highest quality



THE trend toward wider use of steel valves for many services makes Lunkenheimer, who pioneered the development and production of high pressure-high temperature designs, a logical and dependable source of supply.

Here you have top metallurgical research, sound engineering knowledge and design, advanced foundry practice, most modern tools and manufacturing equipment, plus wide experience, to guide you in the selection of your requirements.

The type of valve illustrated is only one of a complete line of steel valves for every industrial purpose. Available in a variety of alloys and trims to suit specific applications . . . gate, globe, angle and check patterns, 150 lb. to 2500 lb. and higher pressures; screw, flange or welding ends.

300 lb. CAST STEEL GATE
Fig. 1938-WD6

Body and bonnet are of Carbon Molybdenum Steel to provide for higher pressure-temperature operation than the limits prescribed for carbon steel. Disc and stem are stainless steel, seat rings high tin content nickel alloy developed by Lunkenheimer—a fine-wearing combination for steam up to 850° F., and general service on water, gas or air.

Lunkenheimer design and construction insure all the essentials for satisfactory and low-cost service.

Helpful Service at Your Call . . .

Lunkenheimer representatives and sales engineers will be glad to work with you on any problem of valve installation and usage. And for your immediate maintenance requirements, call your Lunkenheimer Distributor. He is well qualified to take care of your needs.

ESTABLISHED 1862

THE LUNKENHEIMER CO.

"QUALITY"

CINCINNATI 14, OHIO, U.S.A.

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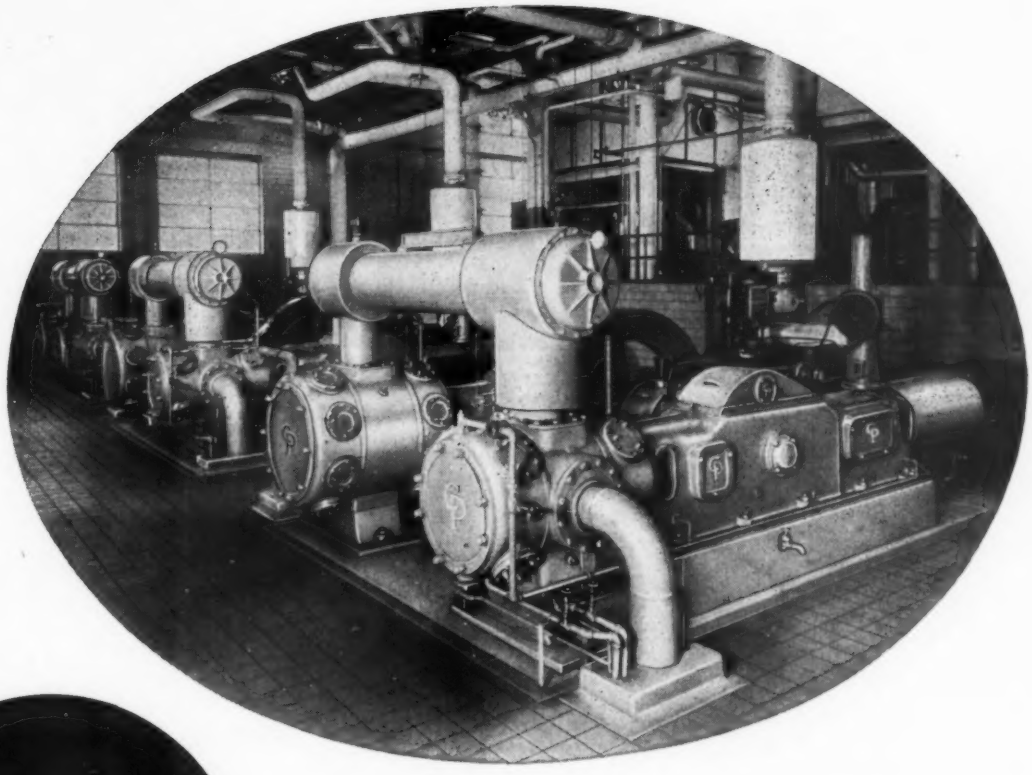
Leadership Through Achievement



low cost air where steam is available

In plants with ample boiler capacity, compressed air requirements can be met effectively, at low cost, with the Chicago Pneumatic Type H Steam-Driven Compressor.

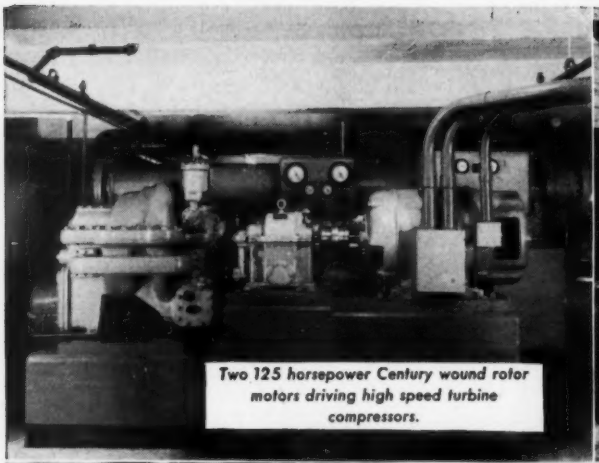
Of horizontal duplex design, its dependability and economy over a wide range of operating conditions are assured by such features as: (1) economical steam end proportioned to the plant's steam conditions; (2) automatic cut-off governor; (3) efficient air end, with Simplate valves.

Capacities of the Type H range from 900 to 7400 c.f.m., 100 to 125 pounds pressure. Other sizes of CP steam-driven compressors are available in single and multi-stage designs for lower and higher pressures.

Write for Bulletin 729.

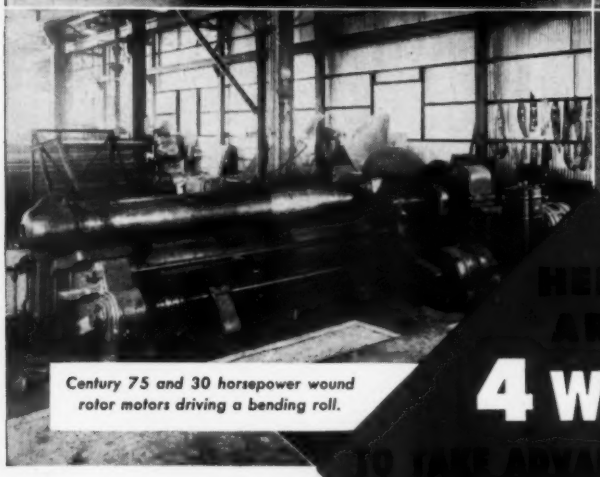
CHICAGO PNEUMATIC TOOL COMPANY
General Offices: 8 East 44th Street, New York 17, N. Y.

PNEUMATIC TOOLS • AIR COMPRESSORS • ELECTRIC TOOLS • DIESEL ENGINES
ROCK DRILLS • HYDRAULIC TOOLS • VACUUM PUMPS • AVIATION ACCESSORIES

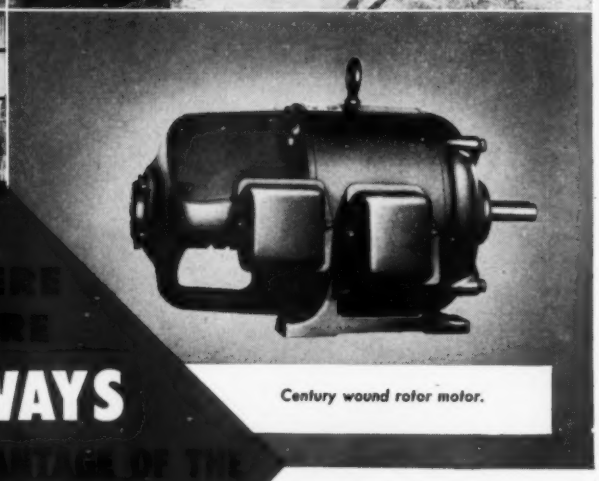


Two 125 horsepower Century wound rotor motors driving high speed turbine compressors.

Century 100 horsepower wound rotor motor driving a refrigeration compressor.



Century 75 and 30 horsepower wound rotor motors driving a bending roll.



Century wound rotor motor.

HERE ARE

4 WAYS

TO TAKE ADVANTAGE OF THE

FLEXIBLE POWER OF

Century

WOUND ROTOR MOTORS

Meet Load Characteristics for:

1. *Adjustable varying speeds control variable process and other load conditions.*
2. *Reversing direction of operation of heavy loads — as in lift bridges.*
3. *Syncro-speed, multiple drives used where two or more operations must be coordinated.*
4. *High starting torque with low starting current — such as reciprocating compressors, steel plate bending rolls, etc.*

Century wound rotor motors are built in sizes up to 400 horsepower and are available in open protected and splash proof frames. In addition, Century builds a complete line of AC and DC motors in sizes from 1/6 to 400 horsepower for all popular requirements.

Specify Century motors for all your electric power needs.

ALTERNATING CURRENT MOTORS

POLYPHASE
Squirrel Cage Induction—1/6 to 400 H.P.
Wound Rotor Motors—1 to 400 H.P.
Synchronous Motors—20 to 150 H.P.

SINGLE PHASE
Split Phase Induction—1/6, 1/4, 1/3 H.P.
Capacitor—1/6 to 20 H.P.
Repulsion Start, Brush Lifting, Induction—1/2 to 20 H.P.

DIRECT CURRENT MOTORS
1/6 to 300 H.P.

GENERATORS
AC, .63 to 250 KVA
DC, .75 to 200 KW

MOTOR GENERATOR SETS
AC to DC, AC to AC
DC to DC, DC to AC

Open Protected, Splash Proof, Totally Enclosed Fan Cooled, Explosion Proof.

Ball Bearing motors are factory lubricated for several years' normal service. Bearing housing construction permits easy re-lubrication when unusual service demands it.

CENTURY ELECTRIC COMPANY
1806 Pine St. • St. Louis 3, Missouri
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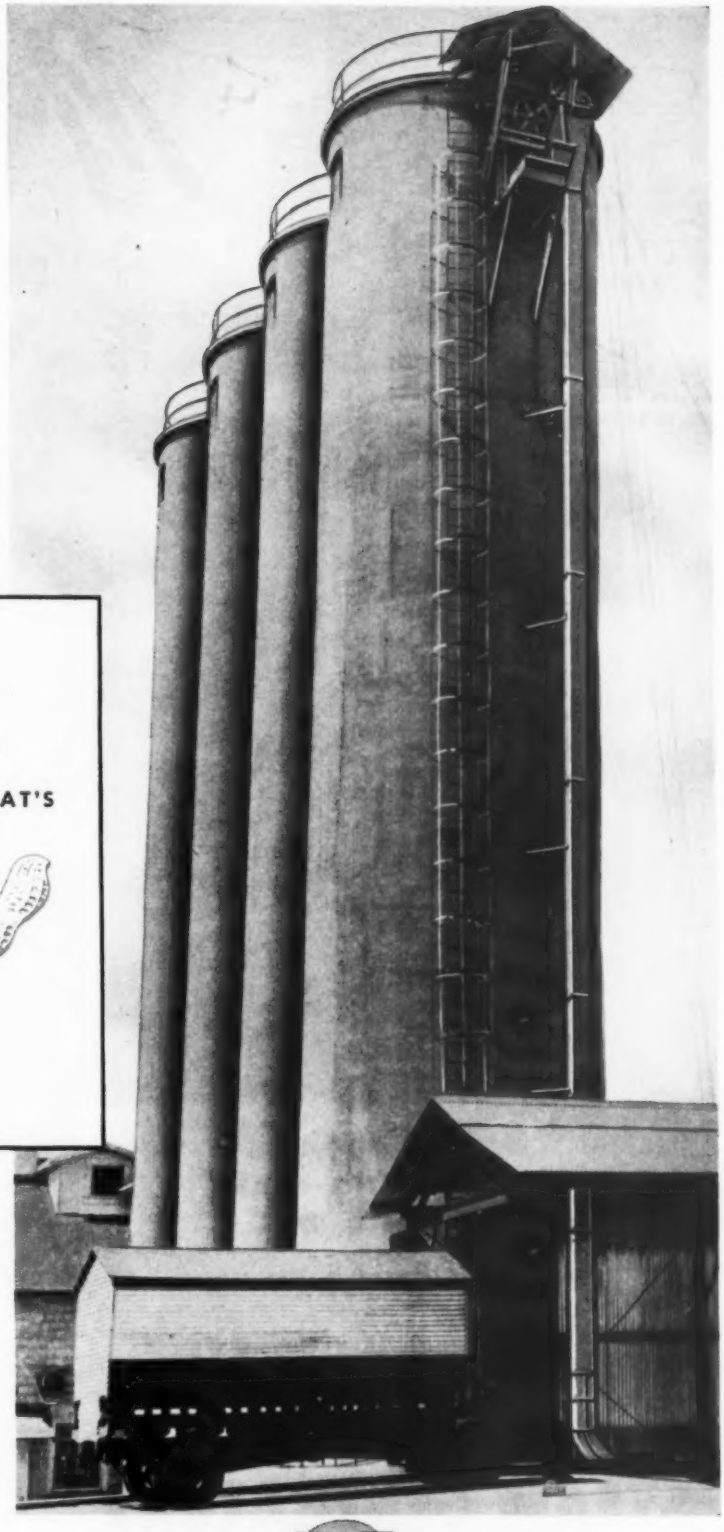
Century C MOTORS

FROM THE S-A RECORD BOOK

Another Example
Another Field
Another Bulk Material



● Moving bulk materials to the right place at the right time and in the right volume is a prime requirement in *any* industry . . . it requires a system designed to operate efficiently at the lowest handling cost per ton.

MANY BESIDES FOOD PROCESSORS COULD USE A BULK HANDLING SYSTEM THAT'S

Working for Peanuts

Stephens-Adamson engineers designed and installed a REDLER handling system to move 22 tons of shelled peanuts per hour to storage without breakage or contamination. Your company may have a similar handling problem . . . or one that's entirely different. The point is, that if your problem involves bulk handling, S-A engineers have the experience and a complete line of equipment to solve it for you.

The record shows that the S-A solution will *materially* reduce handling costs. This service can be invaluable to you . . . and it's yours for the asking. Write us today.

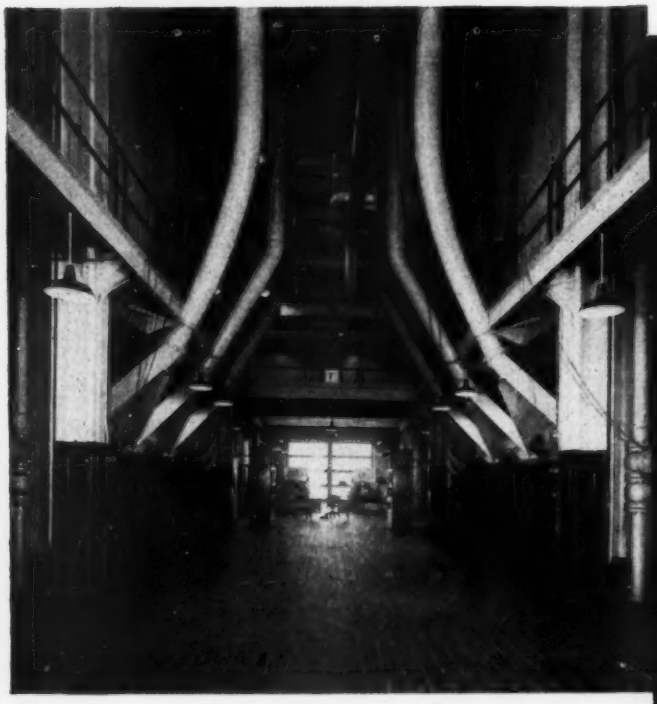
STEPHENS-ADAMSON MFG. CO.

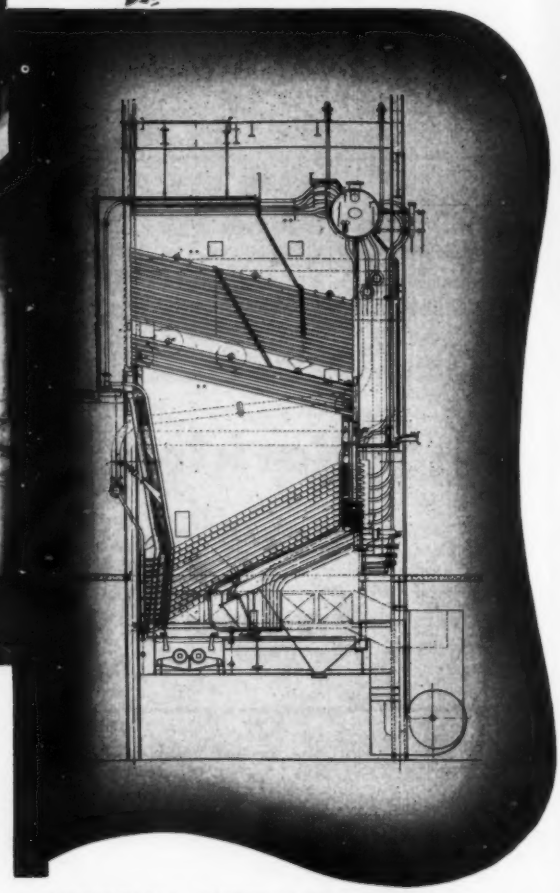
21 Ridgeway Avenue, Aurora, Illinois · Los Angeles, Calif. · Belleville, Ontario

DESIGNERS AND MANUFACTURERS OF ALL TYPES OF BULK MATERIALS HANDLING EQUIPMENT

Federal Works Agency Photos

More Heat for the NATION'S CAPITAL





New $8,000,000
WEST HEATING PLANT
Washington, D. C.

Served By

Vogt FORGED STEEL SECTIONAL HEADER STEAM GENERATORS

ADDITIONAL ORDER NOW BEING FABRICATED FOR THIS PLANT

•

Principal Data, Each Unit

220,000 pounds steam per hour capacity
Steam and water drum is fusion welded and designed for 400 pounds S.W.P.
Sinuous forged steel tube headers. Water cooled furnace walls.

HENRY VOGT MACHINE CO.
Louisville 10, Kentucky

BRANCH OFFICES:
New York • Philadelphia • Cleveland
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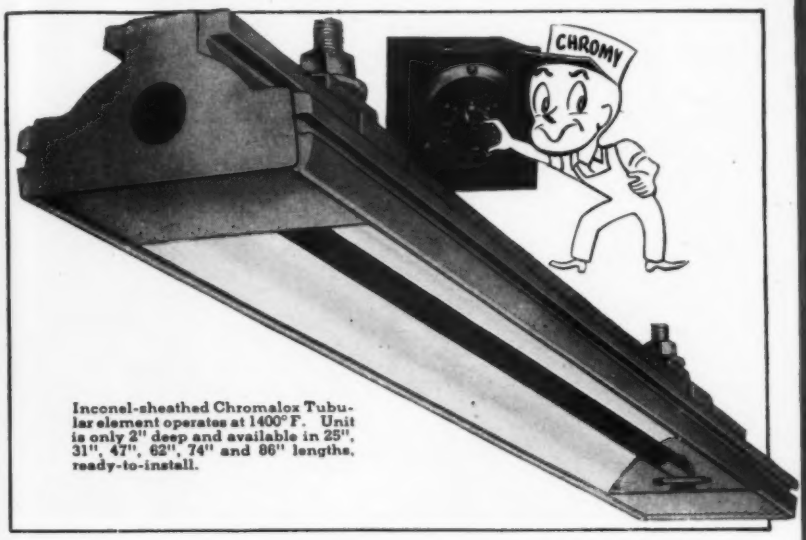
NOW **Dial** YOUR

INFRARED HEAT



Inconel-sheathed Chromalox Tubular element operates at 1400° F. Unit is only 2" deep and available in 25", 31", 47", 62", 74" and 86" lengths, ready-to-install.

WITH **CHROMALOX** ALL-METAL *Electric*

Radiant Heaters

Uniform, exact heat when you want it is yours at the turn of a dial when you use CHROMALOX Electric Radiant Heaters as your heat source for infrared drying, preheating, baking, curing, dehydrating and similar applications.

Quickly and easily installed CHROMALOX Radiant Heaters give uniform heat without hot spots; operate efficiently in low and high ambient temperatures; provide glareless radiation in wave lengths absorbed more efficiently by all colors, textures and surfaces. All-metal construction enables units to withstand shock, vibration, dust, moisture; and eliminates hazards of contamination.

Write today for details on how flexible and dependable CHROMALOX Radiant Heaters can save time, materials and money in your plant.

DIALED INFRARED HEAT WILL GIVE YOU ALL THESE ADVANTAGES . . .

EXACT HEAT CONTROL
Finger-tip control at the turn of the input controller knob assures consistent, exact operating temperatures every time!

PRECISE DUPLICATION
It's easy to duplicate required working temperatures day-in and day-out without guesswork by setting the input controller dial to the logged temperature point.

QUICK CHANGE-OVERS
Within a few minutes after the input controller is reset, you have a new heat to meet changed temperature requirements.

MULTI-PURPOSE or ZONED OVENS
Various zones of heat are possible within the same oven by setting up separate controls for each bank of units. Then each bank can be individually controlled by its own dial.

CHROMALOX } *Electric Heat for Modern Industry*

FACTS ABOUT APPLICATIONS USING CHROMALOX RADIANT HEATERS

Many plants, faced with increasing production costs, have substantially cut working time and costs by using Chromalox Electric Radiant Heaters. If you use heat in your plant for processing, perhaps, you too can benefit by changing to Chromalox Electric Radiant Heat. Look over the typical applications below . . . then send for the full story about this modern heat source.

Application Report 101:
LESS FLOOR SPACE—SAFER OPERATING CONDITIONS are features of a Radiant Heater installation that also provides faster, continuous production for forming soft balls in heated metal molds.

Application Report 102:
SPEEDIER DRYING, NO HOT SPOTS with Chromalox Radiant Heaters result in complete and uniform drying of plastic powders in 10-15 minutes, compared with half-hour with previous heating method.

Application Report 104:
NO DISCOMFORT FOR OPERATOR of punch press while punching holes in plastic strip material. Radiant Heater is used to maintain proper temperature in strips between preheating oven and press.

Application Report 105:
OPERATING IN HIGH AMBIENT TEMPERATURES, Chromalox Radiant Heaters provide a more efficient method for more uniformly knitting asphalt to battery cases. Variable control adjusts heat to battery heights.

Application Report 109:
NO GLARE TO ANNOY PERSONNEL is one feature of Chromalox Radiant Heaters used to dry a cement seal in base of television tubes. Heaters operate on an open conveyor.

Get the complete RADIANT HEATER Application Reports!

Yes . . . send me full details on Chromalox Radiant Heaters.

Name_____

Company_____

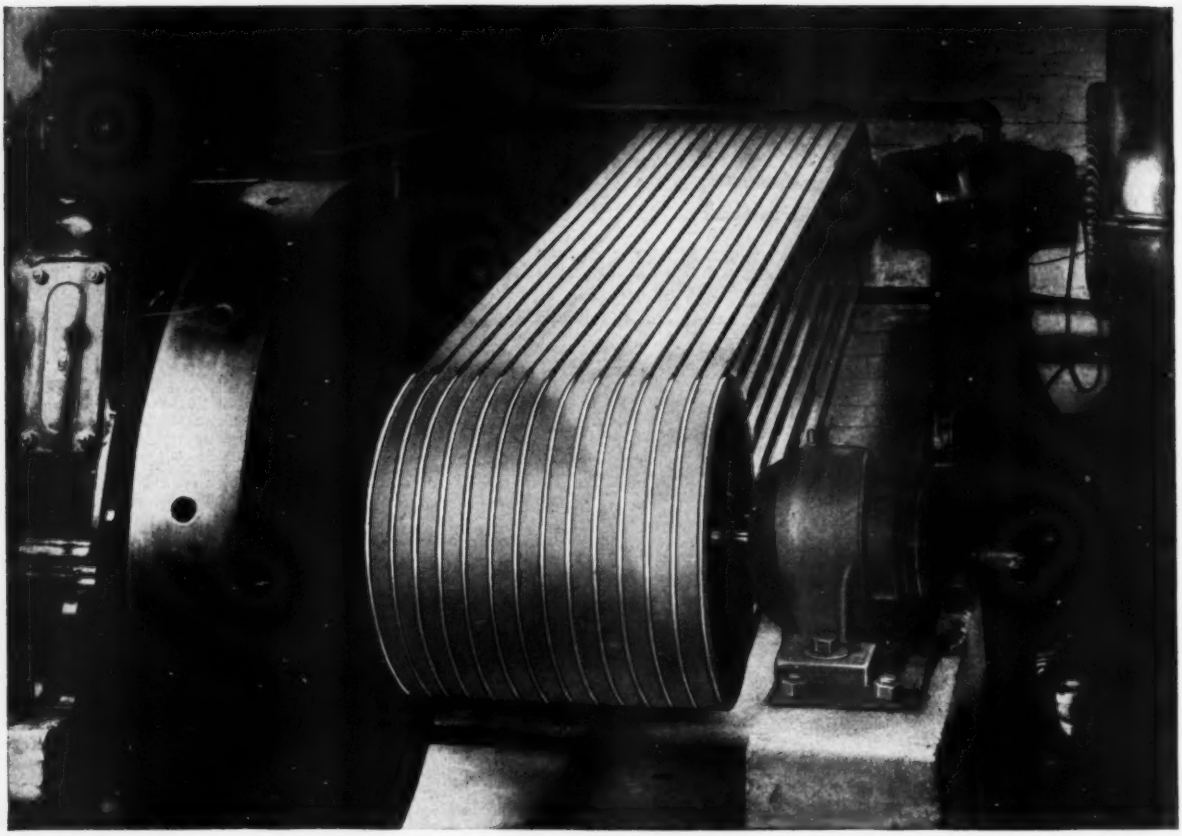
Street_____

City_____ Zone_____

State_____

Mail to: EDWIN L. WIEGAND COMPANY
7510 THOMAS BOULEVARD
PITTSBURGH 8, PA.

IC-48



THE *Smoothest Running* V-BELTS MADE

New Improved *Condor* Whipcord V-Belts

Manhattan Engineers, constantly working to lower your power transmission costs, have developed New Improved Condor V-Belts for still longer life, better wear and smoother running.

Strength members of super-strength synthetic fiber cords, are precision controlled on the neutral axis "power line" of the V-Belt. This precision control is possible only with the Manhattan developed full molding, pressurizing process.

Variation in V-Belt balance is now virtually eliminated—

To you, this means more perfectly balanced V-Belts with longer life, less vibration and wear on your V-Belt powered drives. If you are not already one of the many users who are convinced of the important savings in these New Improved V-Belts, be sure to specify Condor Whipcord V-Belts on your next requisition. Buy through your Manhattan distributor.

(Note: For tough, rugged drives try the new brawny RAY-MAN V-Belts, which are also non-spark, oil-proof and heat resistant.)

DO YOU HAVE THIS FOLDER IN YOUR FILE?

This useful V-Belt Bulletin #6868C will be mailed on request.

Keep Ahead with Manhattan

MANHATTAN RUBBER DIVISION — PASSAIC, NEW JERSEY

RAYBESTOS-MANHATTAN, INC.

Manufacturers of Mechanical Rubber Products • Rubber Covered Equipment • Radiator Hose • Fan Belts • Brake Linings • Brake Blocks • Clutch Facings • Packings • Asbestos Textiles • Powdered Metal Products • Abrasive & Diamond Wheels • Bowling Balls

INDUSTRIAL POWER

March, 1950 Vol. 58, No. 3

PREPAREDNESS IN INDUSTRY

Requires Intelligent Thinking

A. G. Christie
Professor Emeritus, Dept. of Mech. Engineering
The Johns Hopkins University

THE experiences of the last war and the threats implied in the present cold war have convinced American citizens of the need for full military preparedness. As a result, ample funds are made available for military developments so that our armed forces may be prepared for any eventuality. Modern warfare depends wholly on industrial support. Hence, it is emperative that industry shall be prepared for any military demands that may be placed upon it. For this reason industries are being checked to see that physical plant is available and prepared for war service.

However, there are other aspects of industrial preparedness that are equally necessary for the maintenance of American leadership and our high standard of living. First and probably most important is adequate trained personnel in the organization. During the past war, many members of the staffs of companies, particularly the younger and more aggressive men, joined the armed services. Industries struggled through the war with the remaining staff supplemented by hurriedly-trained male and female assistants. Some of these new recruits in industry became capable and have remained with industry. However, many former employees failed to return to their old jobs at the end of the war. As a result certain industries have continued to operate with the less skilled war-time staff. Other industries sought new employees as soon as the war ended and competition developed for trained men.

Low Backlog

At the present time the backlog of post-war orders has been pretty well used up. Many companies have experienced a falling-off in new business and some have gone to the extent of furloughing or dismissing a number of their employees. Graduates of technical schools, who normally are choice recruits for industries, experienced difficulty last spring in obtaining jobs. This is regrettable as many will be permanently lost to industry. To be adequately prepared, many industries should at this moment be adding to their staffs and giving these new men the necessary training.

The preceding statements apply particularly to the possibility of some sudden emergency. But there is another certain but less appreciated threat to American industry, namely, foreign competition.

Relatively few foreign goods have reached American markets during the past ten years, but American products have been shipped to all parts of the world. National prosperity has depended to a considerable degree on the maintenance of these foreign markets. European industry is now being re-established and foreign countries, short of dollars, can only pay for food and other purchases in America by the export of their products. German and Japanese industries in particular must have foreign markets for national survival. American firms must be prepared to meet this influx of foreign competition here and abroad.

Such preparedness presents many serious problems. The high labor rates in the United States lead to high production costs of goods. The only way that American industries can meet foreign competition is to reduce production costs. Such reduction can be effected by increasing the output of goods per man-hour of labor so that the high hourly wages can be spread over a greater number of units of output. This requires much further development either in mechanization, improved production methods or new products to replace present offerings. These developments can be achieved only after much thought, study, and research.

Requirements

Industrial preparedness, therefore, requires that the full efforts of a considerable portion of the staff must be devoted to these developments if foreign competition is to be successfully met. This requirement can only be met in many cases by adding to the present staff and training the new men in the needs of the industry. Young engineers can be employed for research and devolopmental work. More experienced members of the staff could be assigned to production and organization problems. Others may undertake training workers in new methods and procedures.

An appreciation of the need for such full industrial preparedness is one of the most serious considerations before the American public. Our social order and living standards depend not only on military readiness but also on a healthy state of manufacturing establishments and their ability to meet foreign competition. If properly prepared, the United States can continue to lead in the production of goods. Is your industry prepared to meet any contingency?

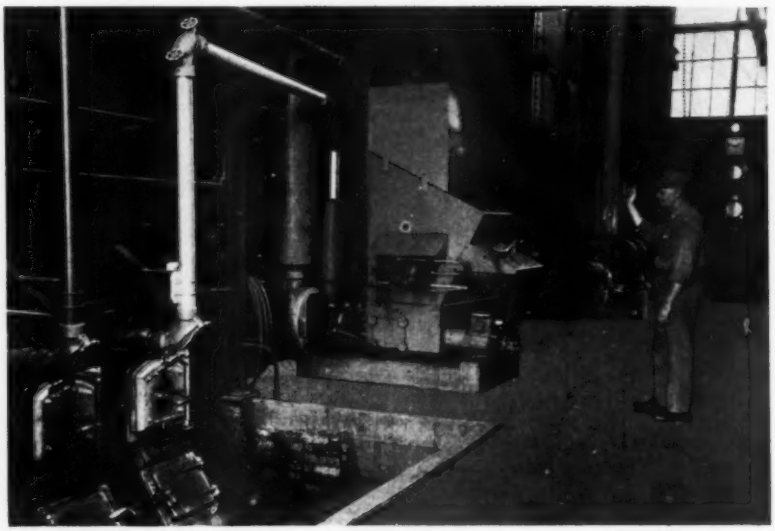
Stoker for Napoleon Solves Problem

Municipal plant's growing load necessitated (Sept. 1948) new 2500 kw condensing turbine generator, and recent installation of two-nozzle pneumatic spreader stoker permits standby boiler to pick up fluctuating industrial load faster and produce at normal rating. Pounds of coal per kwh show consistent decrease.

CLAYTON F. KELLEY,
Superintendent, Napoleon Water Works and Electric Light Plant, Napoleon, Ohio

EVEN before the output of a 1000 kw and a 1500 kw turbine generator in the Napoleon, Ohio, municipal power plant was increased by the addition of a new 2500 kw condensing unit, difficulty was being experienced in meeting the fluctuating demands of the station's industrial load. The plant's largest boiler (rated 462 hp or 35,800 lb per hr) can take care of peaks, but the nature of the load makes it advisable to keep one of the two available 311 hp standby boilers fired and ready to go on the line. The changing demands also were factors in choosing automatic firing equipment that can pick up load faster than the old equipment could.

The preliminary studies of the station's steam generating requirements and available capacities indicated that sufficient steam would be available if either of the two older boilers could be operated at capacity in conjunction with the larger unit. A review of past performances of the two 311 hp boilers indicated that neither of these boilers was producing at its normal rating, although both were in good operating condition.



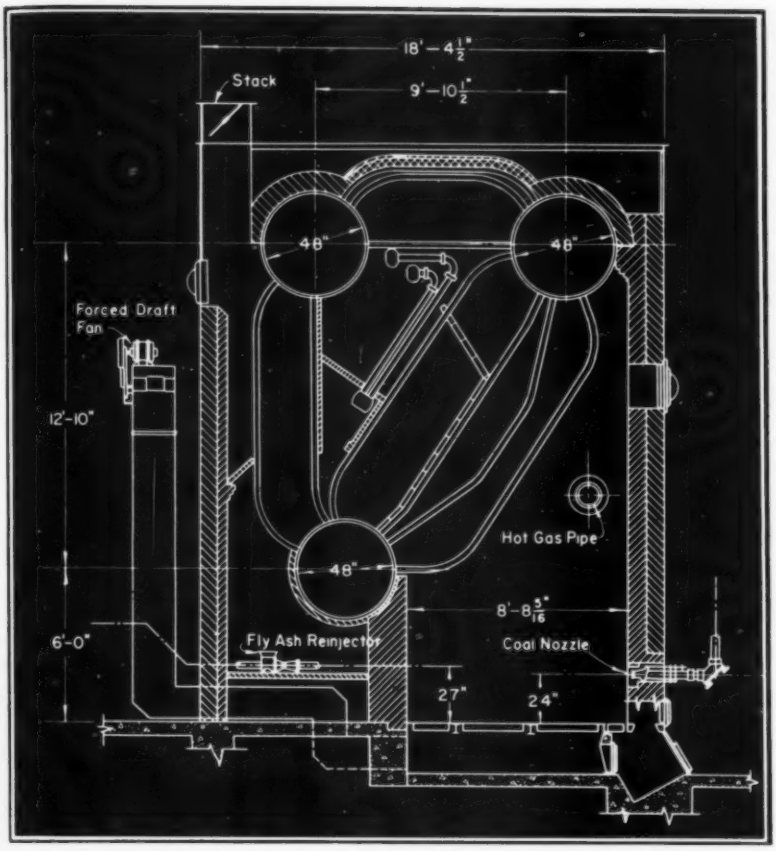
New stoker, installed at right of 311 hp boiler, leaves clear firing aisle.

Rather than install a new boiler, when labor as well as material costs were high and existing equipment was capable of meeting the conditions if properly fired, the members of the Board of Public Affairs decided to install a modern stoker on one of the smaller boilers. The engineering analyses had indicated that the firing equipment would have to be capable of handling wide variations in steam demand to furnish that part of the load not carried by the large boiler, be able to pick up or drop load quickly and economically, and be readily available whenever needed. Oil and gas were considered, but these fuels were found unsuitable for this particular installation.

View of turbine room, new unit in foreground, older units in left background.

Choice

Choice simmered down to spreader stokers and final selection was made of a pneumatic type, which was equipped with dual nozzles and had a nominal capacity of 2400 lb of coal per hr. Space in the boiler room is



Cross section indicates relative position of coal nozzle and fly ash reinjector.

quite limited and an added advantage of the selected stoker was that it could be installed to the right and slightly in front of the boiler. This arrangement saves space and permits keeping the firing aisle clear. Also the side location permits filling the 1500 lb stoker hopper with the same weigh larry that serves the larger boiler.

With the new stoker operating, the maximum rating (of the boiler on which the stoker is installed) is obtained and at the same time a wide range of flexibility is provided to meet the station's unusual surges in power demand.

Each stoker nozzle serves one-half of the boiler grate area, this design permitting one side to be shut down and cleaned while the other is operating.

Coal is metered from the stoker hopper through twin screws (driven by a 1½ hp motor) to transfer sections. Here the coal is picked up and carried to each nozzle through 3½ in. pipes carrying streams of high velocity air. The conveying air is obtained from the side of the furnace and is tempered to 600° F by room air through a damper arrangement. Fine particles of coal are burned in suspension and the heavier particles are distributed by the adjustable nozzles to form a shallow fuel bed on the grate.

Boiler on which the new stoker was installed is a 3-drum type equipped with a convection type superheater which is installed between the second and third passes. Only minor alterations of the fire box were required to adopt the new stoker to the boiler. Furnace has a combustion volume of 610 cu ft with a grate area of 57 sq ft. Grate has a burning rate of 42 lb of coal per sq ft per hr maximum and low of 14 lb of coal per sq ft per hr.

Two individual forced draft fans are installed, one for each section of the divided plenum chamber. The fans are motor driven and are located on a platform at the rear of the boiler.

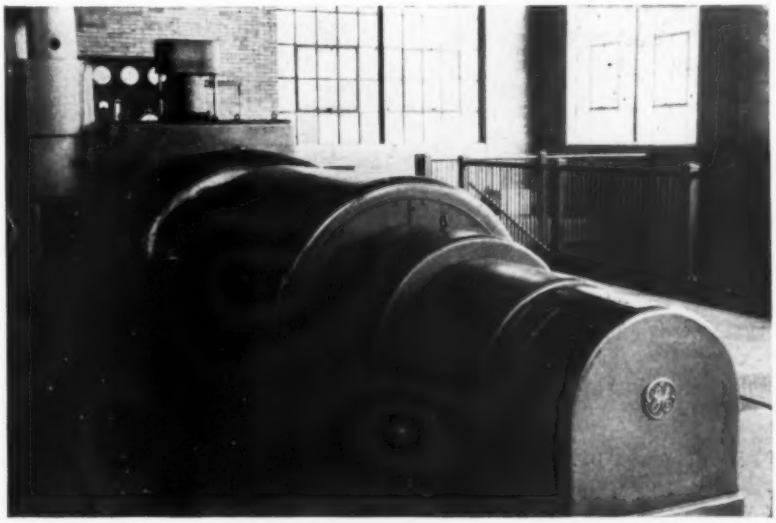
Main controls for operation of the stoker and its auxiliaries are located at a central boiler control panel. A secondary control, which operates in relation to the steam header pressure, is mounted on the side of the stoker and governs the coal feed.

Three ash wells are provided on the centerline of the fire cleaning doors. Ash is drawn into the wells and dampened by sprays to allay the dust before the ash is drawn out onto the boiler room floor. Although the 70,000 lb per hr boiler is equipped with an ash conveying system the auxiliary equipment in the basement prevented the conveyor from being entered so that it would serve the new stoker without extensive remodeling. However, only a small amount of ash is obtained from the wells under the new stoker, and this ash is easily transported to the outside in a wheelbarrow. Fly ash from the combustion chamber and from the base of the stack are returned to the furnace by individual fans.

Turbine

The new turbine is a 12-stage condensing unit, direct-connected to a 2500 kw 2400 v 3 phase generator. Steam is bled at the first, fourth, and eighth stages for a closed feedwater heater, a hot lime soda softening process, and a deaerating heater.

Cooling water for the condenser is



Latest 2500 kw turbine generator is a 12 stage extraction—condensing unit.

obtained from a well in the basement of the power plant. Water flows into this well through a 36 in. gravity line from the Maumee River, the line being approximately 150 ft long and is 40 ft below the surface.

The gravity line is equipped with a traveling screen at the inlet and basket type strains protect pump and other equipment. Cleaning of the baskets depends upon the season of the year and the amount of debris floating in the river. Normally a 4200 gpm pump with a 50 ft head powered by a 75 hp motor supplies the necessary cooling water. However, when the basket on this pump is being cleaned, two 2700 gpm pumps are operated. In winter when the temperature of the cooling water approaches 32° F, only one of the small pumps needs to be operated.

Either a steam-turbine-driven or a motor-driven condensate pump returns the condensate from the hot well through a closed heater to the deaerating heater. These pumps have a capacity of 90 gpm against 134 ft head. Motor is rated 10 hp at 1450 rpm, while the turbine is rated 10 hp at 1750 rpm. Non condensable gases are removed from the condenser by a jet type vent condenser.

Panel Board

A separate panel board is provided for the control of the new turbine. Board contains gages to indicate pressure of first, fourth, eighth, and twelfth stages. A recorder for pressure, temperature and flow of steam to the turbine, a mercury barometer, and a mercury vacuum column, rpm indicator, inlet and throttle pressure gages are mounted on the panel. Another instrument records the temperatures of: the circulating water to the condenser inlet, the water at the outlet, and the condensate—all in degrees F.

New voltage regulators were provided on the main electrical bus when the turbine was installed and a spare panel on the board was utilized for the generator, but otherwise the electrical switchboard was unchanged.

Fan of fly ash reinjection system returns ash and cinder from hopper in base of stack to the boiler room.

Probably the outstanding features of this installation are the increased efficiency obtained by the installation of the new turbine and the manner in which the boilers are now operated. Fig. 1 shows the lb of coal per kwh for the years 1948 and '49. As soon as the new turbine generator was placed in operation in September, 1948, the lb of coal per kwh showed a decrease — except for May 1949 when the 2500 kw unit was out of service for inspection.

Location of the power plant is a big handicap to convenient operation, but no move is contemplated since so much has been invested in the plant as it has grown over a period of years. The original site was selected for a municipal water plant because of its nearness to the Maumee River, but, as the city progressed, the power plant was built here, too. Only a sidewalk separates the stack from U. S. Highway 24.

Coal

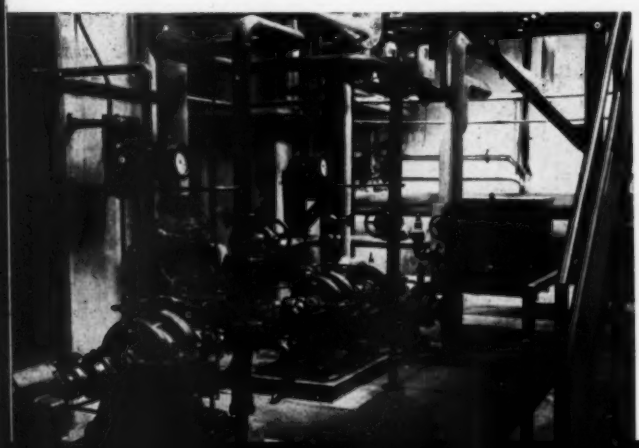
Coal is received by rail in hopper bottom cars at a siding approximately a mile from the plant. The city has its own siding built on a trestle so that the cars can be unloaded directly into dump trucks. At the plant the trucks back up to a ramp and dump their load of coal into an outside storage bin adjacent to the boiler house. In normal times coal shipments are scheduled so that practically all coal is trucked directly to the storage bin. However, a 90 day stock pile of coal is maintained opposite the plant along the river bank. When coal is stockpiled, a mobile clam shell is employed. And when coal is used from this pile, an automatic truck loader is available. Coal from the storage bin is elevated to a 70 ton overhead bunker from which it is discharged into the ½ ton hopper of the traveling weigh larry.

Ash Handling

Ash from the large boiler is discharged into an ash cart which in turn, is dumped into a bucket elevator. The elevator empties into a steel ash hopper adjacent to the coal elevator. All ash is crushed and is utilized by other departments of the city.

Power load at the plant is greatly affected by two local industries, one a canning plant and the other an alfalfa mill. These plants reach a peak in late August and early September and both cause heavy surges in the electrical demand. In order to guard against unusual load conditions, the operator plots the plant load every half-hour in a space allotted on the plant log sheet. Although the load follows somewhat of a regular pattern, the graph enables the operator to predict the general trend of the load.

Tentative plans are being made for the next plant expansion when a new 400 lb boiler will replace the two smaller units. The latter are now the only units in the plant not designed for 400 lb pressure; therefore, as soon as they are replaced, all boilers and turbines will be operated at 400 lb to obtain even greater efficiencies and economies.



Either of these two condensate pumps have sufficient capacity for full load on the large turbine.

LIST OF PRINCIPAL EQUIPMENT

Stoker—Iron Fireman Corporation
Turbine generator—General Electric Co.
Motors—General Electric Company, Westinghouse Electric Corp.
Cooling water pumps—Ingersoll-Rand
Combustion controls—Bailey Meter Co., Hagan Corporation
Pump motors—Elliott Co., General Electric Co.
Vent condenser—Elliott Company
Instruments—Bailey Meter Co.
Recorders—Bailey Meter Co.
Gages—(Ashcroft) Manning, Maxwell & Moore
Mercury columns—Taylor Instrument Co., American Instrument Co.
Condensers—Ingersoll-Rand, Elliott Company
Condensate pumps — Ingersoll-Rand (4), Elliott Co. (2)
Valves—Lunkenheimer Co., Crane Co., Walworth Co.
Coal handling—Jeffrey Mfg. Co.
Fly ash return system—Iron Fireman Mfg. Co.
Blowdown—Yarnall-Waring

STUDEBAKER'S WATER TREATING SYSTEM KEEPS BOILERS ON LINE LONGER

New hot lime-soda process (supplemented by a phosphate treatment) was recently completed at South Bend and is rapidly overcoming scale and corrosion difficulties throughout main maufacturing areas as well as in the boiler house. Automatic controls insure correct and uniform treatment at all times.

JOHN M. BOWMAN,
Superintendent of Power Plants,
Studebaker Corporation, South Bend, Indiana

RECENTLY the Studebaker Corporation completed another phase of the Company's power plant modernization program at South Bend when a new hot process lime-soda boiler feed water treating system was placed in operation. The new water treating system was installed primarily to increase the service hours of all boilers, extend the life of the units, reduce maintenance costs and increase the efficiency of operation.

This system is equipped with automatic controls to minimize supervision and insure exact uniform results, and has the capacity of treating 470,000 lbs. of boiler feed water per hour. A supplementary phosphate treatment is also used to feed phosphate directly into the boiler drums when necessary to reduce the total hardness to zero. The major units of this system include two re-action or sedimentation tanks, a lime and soda mixing tank, eight filters, a phosphate mixing tank together with the necessary feed pumps.

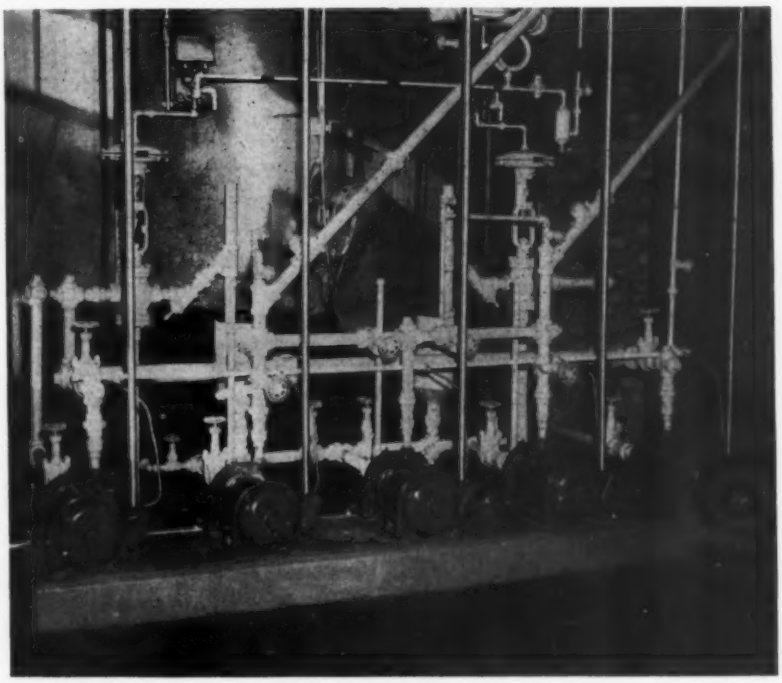
Boiler feed make up in the Studebaker power plant averages around 75% in the summer and approximately 40% during the winter months. Raw water is obtained from a spray pond (which cools water from jet condensers of turbo-generator units), company wells, and city mains. The spray pond or condenser cooling water has the lowest calcium carbonate hardness, 21 grains; well water next with 23 grains; and the city water the most with 30 grains.

Water from any one of the three sources, or a combination of all three is pumped by two motor driven centrifugal pumps (a third having been installed for standby) into either or both of the sedimentation tanks. Premixed lime and soda in solution are pumped into the tanks, the quantity being closely controlled by automatic metering equipment. Steam for the treating process is supplied from the plant low pressure (3 psi) system or directly from the boilers (215 psi) through a pressure reducing valve. Treated water flows from the sedimentation tanks by gravity to a battery of eight filters and is then pumped to the deaerating feedwater heaters.

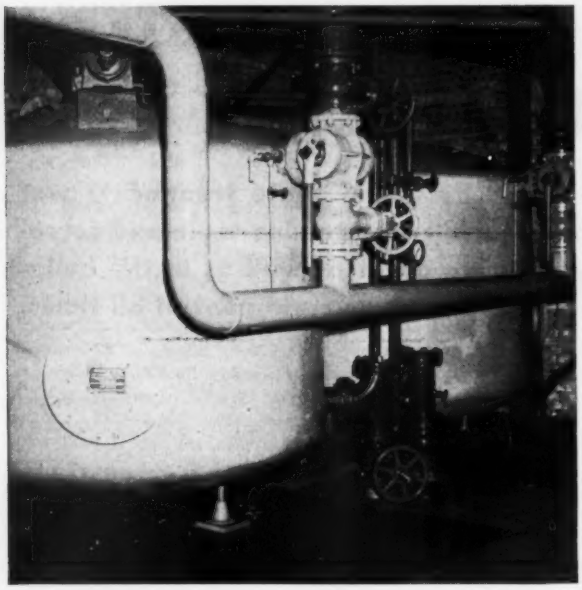
No storage of make up water is contemplated as either sedimentation tank can supply enough treated water for one hour. The hot lime-soda process reduces the hardness content to approximately 0.7 grains and the phosphate reduces the hardness in the boilers to zero.

Chemicals for the sedimentation tanks are mixed in a mixing tank which is 12 ft. in diameter and has a capacity of 3800 gallons. During peak operating conditions the tank is filled with lime and soda once in twenty four hours of operation. For the present water conditions, 3 lbs of lime and 1½ lb of soda are utilized per 1000 gal of raw water. The lime and soda (which are stored in 50 lb. sacks for the lime and 100 lb. sacks for the soda) are dumped into the feed chute of the mixing tank with the necessary water to make a slurry.

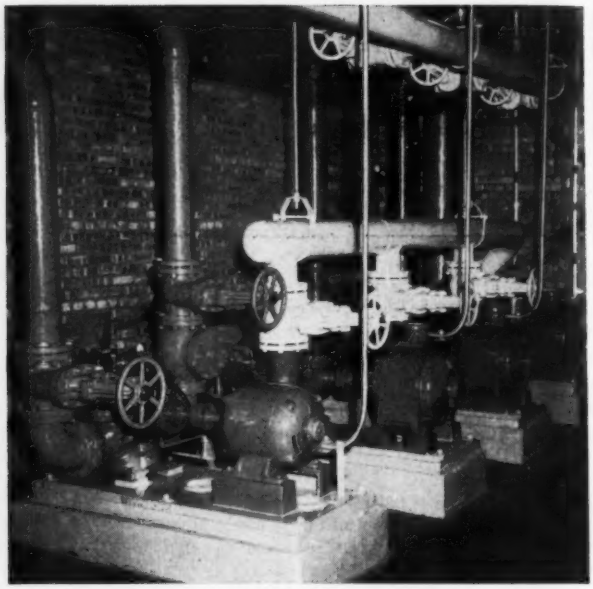
Agitation is provided by a motor driven mechanical agitator, and two pumps continually circulate the mixture. The proportioned chemical slurry is collected in two dilution pots—one for each sedimentation tank. One spare pump, hooked-up to both dilution pots, can supply slurry to either



Chemical feed pumps and circulation pumps are shown installed alongside base of lime and soda mixing tank.



All eight filters, which contain 8000 lb of pea size anthracite coal, remove chemical particles from treated water.



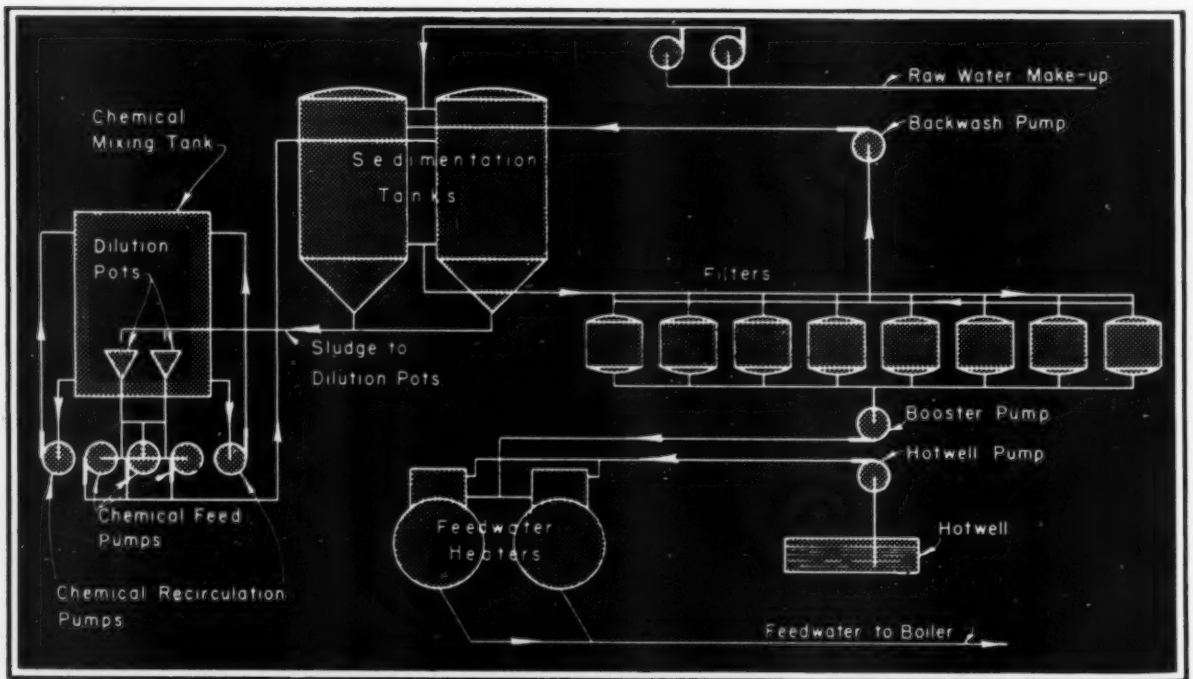
Three raw water pumps, located on right with backwash pump in rear foreground, are interconnected for maximum efficiency.

tank. Some of the sludge from the sedimentation tank is returned to the dilution pots and mixed with the slurry to accelerate the process and also to reduce the amount of chemical.

Flow of the chemical slurry from the dilution pots is accurately controlled through proportioning mechanisms located on the suction side of the sedimentation tanks' supply pumps. A combination flow meter and Wheatstone bridge actuate a timer and a diaphragm-operated shut-off valve that limits the rate of chemical flow. The flow meter, as the liquid passes through it causes the diaphragm valve to open once every three minutes during all load conditions. The length of time the valve is open depends upon the hardness of the make up water and the subsequent setting of the timer. Chemical analysis of the treated water is made every two hours of operation and the timer is set accordingly to either increase or reduce the flow of chemicals. Once the proportioning controls are set, however, the metering of the slurry is automatic.

Under present operating conditions both sedimentation tanks are in operation during production loads and one sedimentation tank is employed for night and week end loads.

Treated water from the sedimentation tanks flows to the filters by gravity. Each filter is a steel tank 7 ft 6 in.



Flow diagram for new water softening system illustrates the flexibility of operation through parallel connection of equipment.

New building for lime-soda equipment has exposed sedimentation tanks, which are insulated to retain heat for processing.

in diameter filled with 800 lb of graduated sizes of anthracite coal. The filters are hooked in parallel with a common supply and discharge headers. Each individual filter is tied into the supply header by means of a three port, two way valve that is operated only when that filter is back-washed.

Filters are operated for a period of 24 hours and then backwashed one at a time. The suction side of the backwash pump is connected to the two way valves located at the filter inlets. Each filter outlet header contains 59 self-lifting strainer valves that slow down the rate of flow when the units are filtering treated water. However, when the two way valve is opened to shut off the supply from the sedimentation tank, and the pump started, treated and filtered water is drawn from the common discharge header. As the flow is reversed the valves open, and the backwash water is returned to the sedimentation tanks. The entire backwashing process is completed in only thirty minutes.

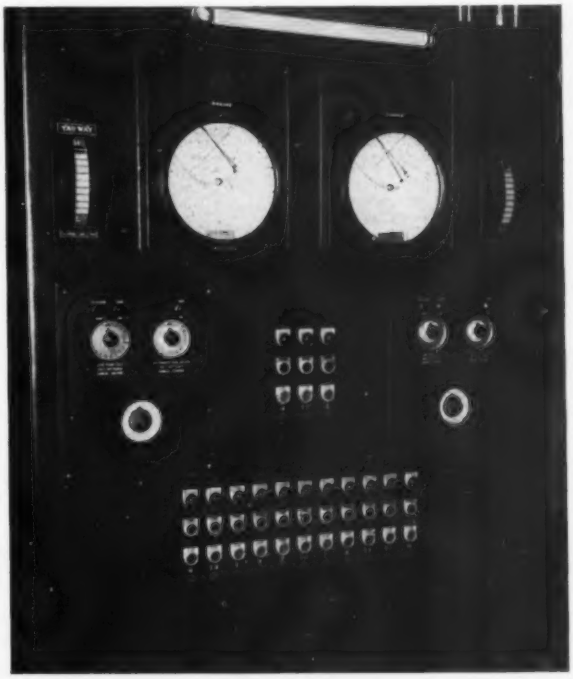
After the treated water is filtered, it is picked up by a booster pump and circulated to one of two multi-jet feedwater heaters. Each heater is 10 ft in dia. by 24 ft long and has a storage capacity of 1680 cu ft. An 8 ft dia deaerator, which contains cast iron separating trays, is mounted on the top of the heaters. The tray stacks are completely housed, and the shell and head plates are exposed to clean incoming steam or deaerated water. Positive pressure is maintained in this housing, with the oxygen being reduced to below 0.005 cc per liter of effluent water. Degasification and concentration of gases take place in a separate tray stack housing located in the heater top. This compartment is readily accessible for cleaning and maintenance. Steam vented from the heater —approximately 35,000 lb per hour — is discharged into the sedimentation tank to supplement the steam from the boilers.

After an analysis is run on the treated water, the automatic soda and lime metering controls are set. If it becomes necessary to reduce the hardness to a greater degree, a battery of seven phosphate chemical feed pumps is started. These pumps feed phosphate to the drum of each boiler that is on the line. Metering of phosphate to the drums is controlled by a cycle control timer which controls the number of minutes the pump will operate per hour. The capacity of each pump can be altered by changing the length of stroke of the pump or by replacing the plunger unit assembly with a larger or smaller assembly. The average phosphate concentration provided by these pumps is intended to be 30 ppm.

All of the lime-soda process equipment is housed in a new 42 ft by 47 ft two story structure, with the second floor allocated entirely to chemical storage. Chemicals are received in 30 ton lots by rail and are unloaded from a conveniently located railroad siding adjacent to the water treatment house. Phosphate, since this process equipment is not located in the new building, is stored in 500 lb paper drums in the boiler house.

Color schemes employed throughout the Studebaker power plant were adopted for all equipment and piping in the new water treatment building. Units, such as pumps, motors, and heavy operating apparatus are given a coat of willow green. The over-all color scheme is as follows: high pressure steam (200 psi)—orange; low pressure steam (3 psi)—buff; raw water — white; treated water — dark green; back wash water—light blue; chemical—yellow; air supply—white with black banding; electrical conduits—aluminum; and all structural steel and tanks—light grey.

The present modernization program in the Studebaker Automotive Power Plant was inaugurated in 1940 and since that time three new boilers, a new twin air compressor, and the feed water treating plant have been installed. The three boilers are rated at 210,000 lbs per hour each, at 200 psi 500° F steam. The air compressor has a capacity of 3000 cfm, at 115 psi. Installation of the latest boiler unit was made in May 1949, while the air compressor was installed in October of 1949, and the treating plant was completed in December 1949.



Panel board contains controls that operate the chemical soda-lime process to soften 470,000 gph of raw water.

SYNTHETIC OIL EXTRACTED FROM CALIFORNIA SANDSTONE

Based on a recent report of the Bureau of Mines, this article describes results and laboratory procedures on the recovery of oil from bituminous sandstone deposits. Latest tests indicate that efficient bitumen extraction of 24.7 gallons per ton of stone by the hot water separation process is possible.

G. B. SHEA, Senior Petroleum Engineer, and
R. V. HIGGINS, Associate Petroleum Engineer, Bureau of Mines,
Petroleum Field Office, San Francisco, Calif.

RESULTS of recent laboratory tests indicate that the extraction of oil from bituminous sandstones by the hot water separation process may have some possibilities in supplementing our future synthetic fuel supply. Recovery of bitumen—the tarry substance from which gasoline and oils are extracted—has reached 24.7 gal per ton of sandstone.

Research on oil-impregnated sandstone deposits found near Edna, California was started during the early years of World War II, when the petroleum industry along the West coast was hard-pressed to satisfy the expanded demands for petroleum products, particularly fuel oil. Although the urgency of the demand was eased somewhat by the ending of the war, the studies are continuing; unprecedented postwar needs may cause exploitation of bituminous sandstone deposits sooner than previously anticipated.

To date the tests have demonstrated that the hot water method may be applied satisfactorily to separating hydrocarbons from sandstones, but the presence of mineral salts and fine silt in the Edna samples still complicates the operations. The work has not yet advanced to the pilot-plant stage and certain operating problems remain to be solved.

Principles

Basic principle of the hot water separation process is the displacement of bitumen from sand grains by water. Whether the oil is completely displaced depends upon the properties of the water. The tests have disclosed that certain alkaline solutions are more effective than pure water and complete displacement takes place when the sandstone is neutral or slightly alkaline. Complete displacement also de-

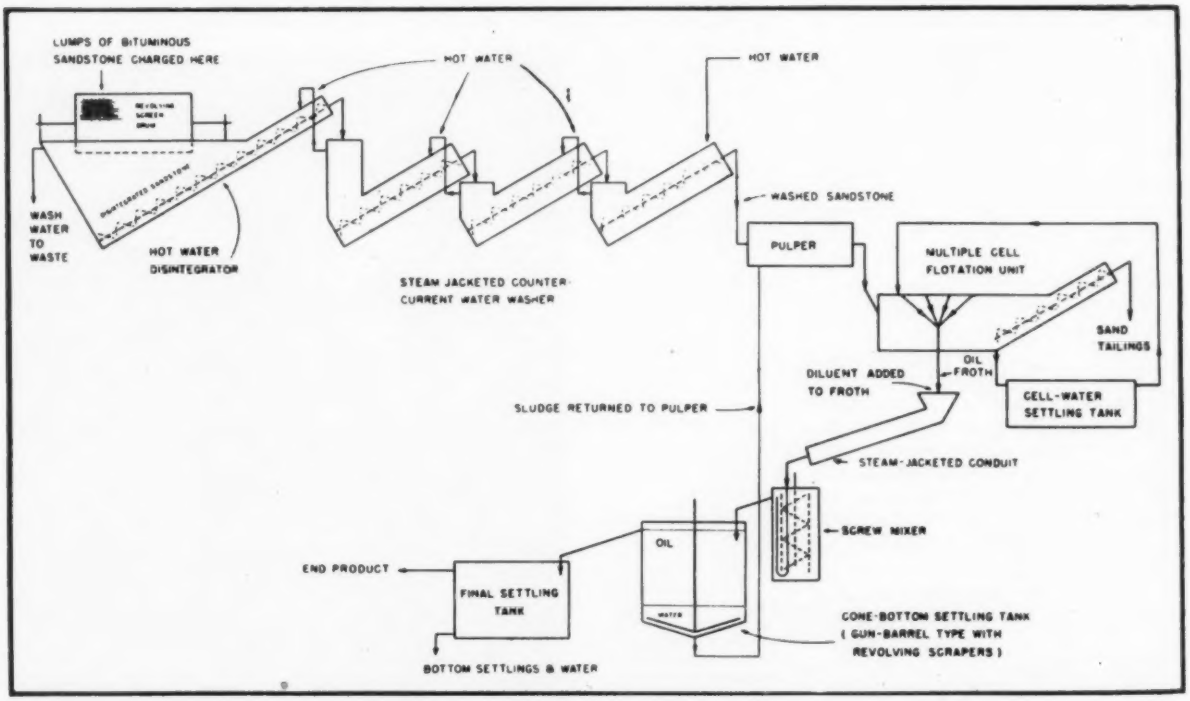
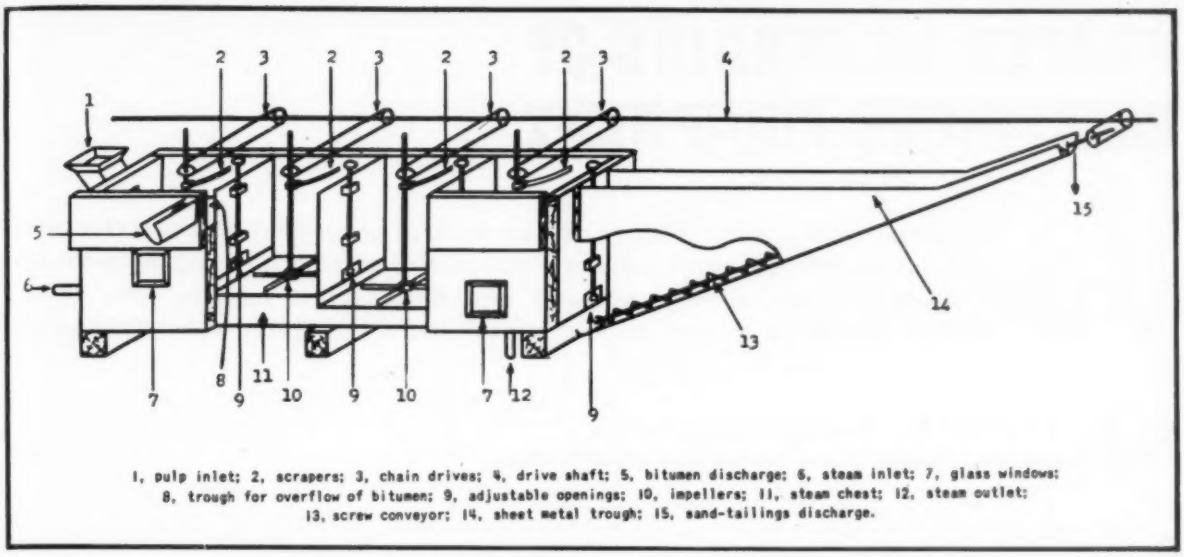


Fig. 1—Flow sheet of laboratory hot water separation plant.



1, pulp inlet; 2, scrapers; 3, chain drives; 4, drive shaft; 5, bitumen discharge; 6, steam inlet; 7, glass windows; 8, trough for overflow of bitumen; 9, adjustable openings; 10, impellers; 11, steam chest; 12, steam outlet; 13, screw conveyor; 14, sheet metal trough; 15, sand-tailings discharge.

Fig. 2—Diagrammatic drawing of multiple-cell flotation unit.

pends upon a thorough disintegration and mixing of sandstone with the displacing medium.

Aside from giving the sandstones a preliminary hot water bath, the system consists of three major operations:

1—Heating and mixing the bituminous sandstone with enough water and alkaline reagent to form a pulp, in which the bitumen is displaced from the sand grains by the water. Efficient separation also depends on the occulation of enough air in small bubbles in the pulp to form an oil froth

2—Separating the oil froth from the sand by submerging the pulp in hot water. The oil froth floats to the surface and the sand grains, free of bitumen, sink to the bottom

3—Removing the water, sand, and silt from the oil froth by dilution of the bitumen with light oil, and then settling.

Solubility

Soluble mineral salts in Edna sandstones, consisting largely of iron and calcium sulfates with some sodium and aluminum sulfates, made water-washing of the sandstone necessary. These impurities were found to have a detrimental effect upon the recovery of bitumen, as they reacted with the alkaline reagents used in the pulping. They also precipitated insoluble gelatinous iron and calcium hydroxides, which formed slimes with the fine silt released in the pulping operation. In early tests the slimes were deposited on the sand bed in the flotation cells and impeded separation of the bitumen; in fact, the slimes were found to contain up to 50% of the bitumen.

Preliminary washing with hot water removed nearly all of the soluble iron and calcium salts, and thereby eliminated one of the more troublesome problems of earlier experiments. Hydrolysis of the ferrous sulfate made the sandstone distinctly acid, which precluded the separation of any bitumen in the washing process. Also, removal of salts reduced the quantity of reagent necessary to maintain alkalinity.

Separation

In the hot water separation process sandstone is discharged into a revolving screen drum, which is partly submerged in a tank of hot water (Fig. 1). As the drum revolves, the hot water, aided by the abrasive action of the sandstone lumps and the rolling action of several iron balls inside the drum, disintegrates the lumps to particle sizes small enough to pass through 6-mesh screen.

Disintegrated sandstone receives a first washing as it falls through the water to the bottom of the tank and is removed slowly by a screw conveyor. Partly washed sandstone falls from the end of the screw conveyor into the first unit of the multi-stage countercurrent washer, where it is slowly churned through the wash water by a screw conveyor into the second and similarly, into the third unit of the washer. The washed sandstone is discharged from the last unit onto a screen, where some of the contained water is drained off before the stone is transferred to the pulper. The hot wash water flows through the tanks concurrently to the movement of the bituminous sands and becomes progressively enriched with soluble salts. The water is trapped between each tank and the silt is allowed to settle out. Each tank is steam-jacketed and the temperature of the wash water is maintained at 175° F.

To form a frothy alkaline pulp the washed sandstone is heated to 210° and mixed in a rotary pulper with a light gravity fuel oil diluent and aqueous solutions of sodium carbonate and/or sodium silicate. Addition of the light oil diluent to the pulp facilitates displacement of the bitumen by solvent action. Then too, flotation of the froth was speeded by reducing the viscosity and specific gravity of the bitumen.

Oil Froth

Oil froth is separated from the sand grains by introducing the pulp into hot water at 210° F in the multiple-cell flotation unit shown in Fig. 2. Pulp is dumped into a hopper, which automatically delivers the mixture at a predetermined rate into the first compartment of the unit. Impeller blades churn the pulp and most of the aerated oil froth separates from the sand and rises to the surface of the water. Additional churning takes place in the remaining three cells. The sand tailings from the last cell are removed by means of a screw conveyor. Revolving horizontal scrapers skim the froth from the water into a discharge trough, at which point additional diluent is added. The froth-diluent mixture then passes through a steam-jacketed conduit to the screw mixer.

The slow action of the screw thoroughly mixes the bitumen in the diluent, and the diluted solution overflows through the outlet near the top of the mixer. A constant temperature of 180° is maintained on the mixing tank.

(Continued on page 119)

PROPER GROUNDING OF ELECTRICAL EQUIPMENT

In this second article of his series on neutral grounding of industrial power systems, the author continues his description of grounding methods for medium and low voltage systems and discusses in addition the selection of resistors, as well as the grounding of portable electrical units.

W. F. STRONG, Industrial Power Division
Industrial Engineering Divisions, General Electric Company

SOLID and low-value reactance methods of grounding generally produce high magnitudes of fault current, and resistance grounding produces low values. In medium voltage systems, considerable kva capacity is often present in large, expensive, rotating equipment such as generators and motors. Ground faults which occur between the rotating machine windings and laminations may cause severe "burning" of the iron if the fault current is high or persists beyond a few cycles. This type of damage is costly, since it means both re-stacking and rewinding the machine, which, in addition, is out of service for a long period. Consequently, in medium voltage systems, a fault current low in magnitude is desirable to aid in restricting the damage to one or two coils of the winding that can be quickly and inexpensively replaced. For these reasons, resistance grounding is recommended for medium voltage systems. An example is indicated by Fig. 5.

Also in the case of low voltage systems, low fault currents are desirable. However, in this instance, the resistance of the ground return path may greatly reduce the actual fault current in comparison with the available current. For example, the three-phase fault current on a 13.8 kv circuit supplied by a 15,000 kva transformer is 18,000 amperes. A value of 0.1 ohm ground resistance has practically no effect and the ground current is also 18,000 amperes. But a 480 volt circuit supplied by a 1000 kva transformer has 17,300 amp, three-phase fault current, and only 2750 amp ground-fault current for 0.1 ohm ground resistance. Therefore, to insure positive tripping of circuit breakers and because of ground resistance effects, low voltage systems should be solidly grounded. Fig. 6 supplies an example.

TABLE II
Grounding Low-Voltage Systems

		240/120 volt 1-phase	208Y/120 volt 3-phase	230 volt 3-phase	460 volt 3-phase	575 volt 3-phase
Practice Grounding		Always operate grounded[1]	Always operate grounded[1]	Desirable to operate grounded.[2] If system is new, prefer changing to 460Y.	operate grounded[3]	operate grounded[3]
Systems having WYE-connected generators	Practice	Ground generator neutrals solidly or through low-value reactance.				
	Remarks	1. Total capacity of generators should be adequate for grounding. See Table V. 2. Grounding reactor is required only where generator is not sufficiently well-braced to withstand magnetic foces of ground fault current when neutral is solidly grounded. Check generator manufacturer for generator reactance and braced rating.				
Systems NOT having Wye-connected generators	Practice	Solidly ground transformer mid-tap	Ground transformer neutral solidly	Use standard, RM delta-connected substations plus grounding transformer. Alternatively operate ungrounded.	Use wye-connected secondary, unit-substations with neutral grounded solidly. If only delta-connected transformers available, use grounding transformer or operate ungrounded.	
	Remarks	1. Total capacity of transformers should be adequate for grounding. See Table V. 2. Grounding transformers, if used, should pass ground fault currents equal to at least 25% of 3-phase value. Check adequacy of this fault current for tripping circuit breakers and any fuses on system. Cannot take single-phase, line-to-neutral loads off system when grounding transformer is used.				

Notes: 1. Requirement of National Electric Code (section 2514)
2. Standard RM transformers are delta-connected, thus decision to ground is affected by cost of grounding compared with value of protected system.
3. Standard RM transformers are wye-connected thus cost of grounding is low compared with advantages obtained.

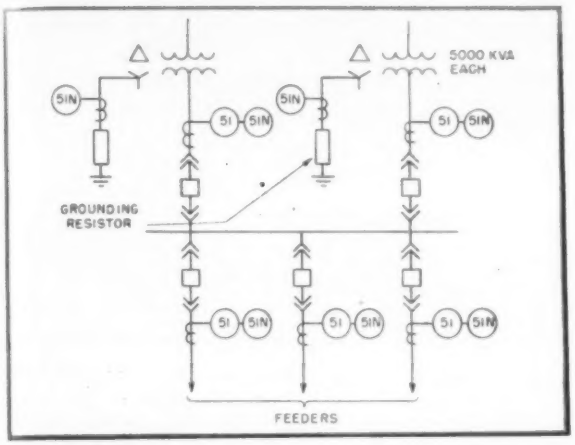


Fig. 5 — Medium voltage systems require a low magnitude fault current to restrict damage to coil windings.

TABLE IV

Grounding Resistor Current
Rating in Percent of System CT Ratings

Equipment Protected	Types of Relaying		
	Ground Over-current	Differ-ential	Pilot Wire
A. Wye-connected generators, motors and transformers	100%	100%	....
B. Delta-connected generators, motors and transformers	40%	40%	....
C. Lines & Cables	20%*	....	50% (type CPD) 150% (type IJD)
D. Buses	....	50%	....

*Where ground overcurrent relays for lines and cables also serve for back-up protection for machines or transformers, this value should be 100 percent.

Low Voltage

In addition to the general conclusion that low voltage systems should be grounded, several pertinent factors which influence the decision in specific instances should be considered. For that purpose a tabulation of recommended practice, Table II, for the common voltage levels is provided.

In only one case, namely 230 volt systems, is a delta-connected secondary transformer the only standard. In such systems either a grounding transformer may be employed to establish a neutral or the system may be operated ungrounded. In practice, a grounding transformer for a low voltage system is relatively large so that its impedance will be low enough to pass sufficient fault current to trip circuit breakers and fuses. Thus, the economics for 230 volt systems may indicate ungrounded operation. However, in all other cases the neutral may be readily provided and the advantages of grounding can be obtained at little or no increase in system investment.

When a generator neutral is used for grounding, the ground-fault current may exceed the three-phase fault current which the generator can produce because of the characteristic low zero-sequence reactance of generators. This value of current may exceed the rating for which the generator is braced. Accordingly the addition of a low-value reactance, in the neutral of a generator which is used for grounding, is necessary.

A summary of grounding practice for medium voltage systems is given in Table III. In this class, too, certain voltage levels are commonly provided with wye-secondary transformers and

TABLE III

Grounding Medium Voltage Systems

Grounding Practice		2400 volt 3-phase	4160 volt 3-phase	4800 volt 3-phase	6900 volt 3-phase	11.5-13.8 KV 3-phase
		Desirable to operate grounded[1]	Operate grounded[2]	Desirable to operate grounded[1]	Desirable to operate grounded[1]	Operate grounded[3]
Systems having WYE-connected generators	Practice	Use Resistance Grounding				
	Remarks	1. Generators used for grounding should be of adequate size. See Table V. 2. When severe lightning exposure is present, generator may be grounded through low value reactance to permit use of grounded-neutral type of lightning arrestors. 3. Small systems, where the resulting ground fault current would not be excessive, may be reactance grounded if desired in the interest of economy.				
Systems NOT having Wye-connected generators	Practice	Use standard delta-connected transformers plus grounding transformer resistance grounded	Use wye-connected secondaries in transformer stepping down to this level; resistance grounded	Use standard delta-connected transformer plus grounding transformer resistance grounded	Use standard delta-connected transformers plus grounding transformer resistance grounded[3]	Use wye-connected secondaries in transformer stepping down to this level; resistance grounded
	Remarks	1. Transformers used for grounding should be of adequate size. See Table V. 2. In small systems where the resulting ground fault current would not be excessive, power transformers or grounding transformers may be solidly grounded in the interest of economy.				

Notes: 1. Standard RM transformers are delta-connected, thus decision to ground is affected by cost of grounding compared with value of protected system.
2. Standard RM transformers are wye-connected, thus cost grounding is low compared with advantages obtained.
3. In 6900 volt steel mill systems having large transformers, the 6900 volt winding of source transformers (not 6900 volt—low voltage load center unit) should be wye-connected to facilitate grounding.

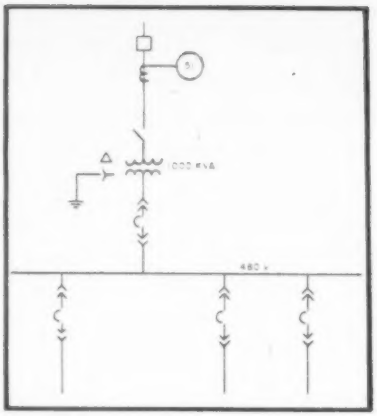


Fig. 6 — Typical grounding diagram indicates positive method for tripping circuit breakers.

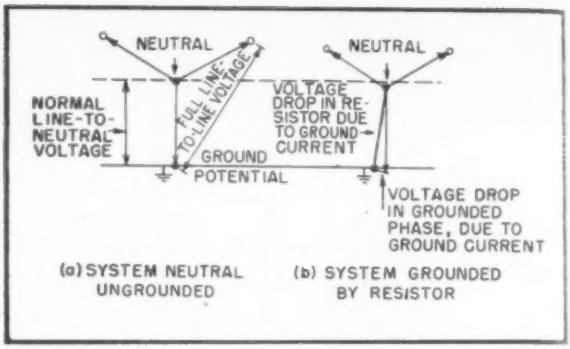

NEUTRAL
NEUTRAL
NORMAL LINE-TO-NEUTRAL VOLTAGE
FULL LINE-TO-LINE VOLTAGE
VOLTAGE DROP IN RESISTOR DUE TO GROUND CURRENT
GROUND POTENTIAL
VOLTAGE DROP IN GROUNDED PHASE, DUE TO GROUND CURRENT
(a) SYSTEM NEUTRAL UNGROUNDED
(b) SYSTEM GROUNDED BY RESISTOR

Fig. 7—Ground resistors will pass full rated current when a fault occurs in this system.

can therefore be grounded at no additional cost for establishing a neutral. These are 4160 volt and 13.8 kv levels. In addition, these voltages make best use of the standard circuit breakers and offer economy in the application of other system components.

Resistor Selection

Grounding resistors are commonly specified by their current rating. An 800 amp resistor is one which will pass 800 amp current when a ground-fault occurs in the system. The resistor ohmic value is equal to system line-to-neutral voltage divided by its current rating. For example, a 1000 amp resistor for a 13.8 system has

$$\frac{13{,}800}{1000 \times 1.732} = 8 \text{ ohms}$$

A 1000 amp resistor for a 4160 volt system has 2.4 ohms resistance. The system impedance has only a small effect on the magnitude of ground-fault current, since it is chiefly reactance and this adds, Fig. 7b, at right angles to the grounding resistance.

Factors which determine the current rating of a grounding resistor for a particular system are: (1) the minimum value of ground-fault current which will provide positive tripping of ground relays, and (2) the maximum value which will avoid excessive damage in the event of a fault.

Requirements

Studies of relaying requirements of generators, transformers, feeders, and other parts of power systems have led to general recommendations for ground-fault protection of them. These conclusions are summarized in Table IV. The explanation of this table is as follows:

(1) Each relay in the system has a minimum grounding resistor current rating, which will provide adequate fault protection. Therefore, to determine a single grounding resistor that will be suitable for all relays, the largest current rating, in accordance with Table IV, should be selected.

(2) For example, in Fig. 8, one generator has a 1200/5 CT. Assuming differential protection, Table IV, Part A, shows that the grounding resistor current rating should be 100% of the CT rating or 1200 amperes. For the tie circuit, assuming ground over-current relays, Part C of the table shows that the grounding resistor current rating should be 20% of 800 amp or 160 amperes. Surveying all other CT's and relays in the system, the 1200 amp is found to be the largest figure and should be specified for both grounding resistors. An important fact to note is that both resistors should be rated 1,200 amp, since times may be encountered when only one generator is in operation. This means a total ground current of 2400 amp when both generators are operating.

Standard current ratings of grounding resistors are: 300, 400, 600, 800, 1200, 1500, 2000 amperes. The standard voltage ratings are the line-to-neutral and the line-to-line voltages of the system. Both are given to avoid confusion as to which voltage is meant. Thus, for a 2400 volt system, the line-to-neutral voltage, and therefore, the resistor voltage, is 1380 volts. Likewise standard resistors are designed for 4160, 6900 volt, and 13.8 kv systems.

Grounding resistors are usually specified to withstand rated current for 10 seconds. In some instances 30 second or one-minute resistors may be thought applicable to permit time for an operator to shift load or change other system operating conditions before the resistor backup relay operates. However, experience has shown that this interval is far too short for any switching to be done; consequently 10 second resistors are recommended.

Cast-grid resistors are utilized for indoor service and stainless steel for outdoor installations.

A complete grounding resistor specification includes: current rating; system voltage; whether cast grids or stainless steel units are to be used; and time interval rating.

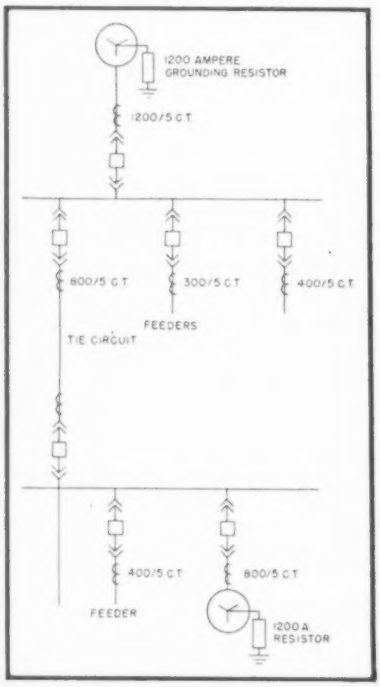


Fig. 8—Relay grounds are sized according to the minimum capacity of largest resistor.

Portable Units

In large excavating operations — such as open pit mines or wherever electrically-operated, portable machinery is employed—a shock hazard is present whenever a ground-fault occurs in the equipment. Properly grounding the supply system neutral will minimize this hazard. Methods in such cases include high resistance grounding which will produce approximately 50 amp ground-fault current. Sensitive ground relays must be included to isolate faulty circuits from the remainder of the system. A ground return path, provided by cable ground wires plus overhead ground wires, should have a maximum resistance of two ohms to limit the possible shock voltage to 100 volts. In practice, the actual shock voltage will be less due to the shunting effect of the earth resistance itself.

The third and final article is scheduled for next month's issue.

AIR EJECTORS & RELIEF VALVES NEEDED FOR CONDENSER SYSTEMS

Continuing his discussions of industrial turbine condensing systems and equipment, the author supplies data, several curves, and basic information necessary to insure proper selection of these important components. This is the third and last article of a series.

TYLER G. HICKS,
Hicks Associates, New York

VARIOUS factors that are important in planning condensing systems for industrial power plants were discussed in the first two parts of this series. Knowledge of these factors is of value to industrial plant engineers and executives because applications of condensing turbines are rapidly increasing in many areas. In this final article of the series, information is supplied on two other important components of the condensing system—steam jet air ejectors and atmospheric relief valves.

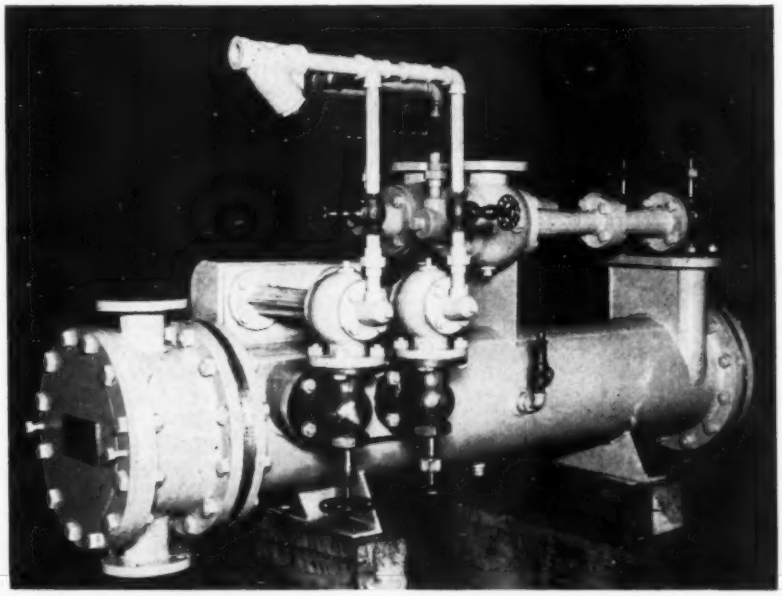
Air Ejectors

Atmospheric air enters condensing systems through leaks in joints, glands, and packings. A small amount of noncondensable gas also enters the condenser with the exhaust steam from the turbine. Since air and other noncondensable gases are poor conductors of heat, they must be removed from the condenser to prevent a reduction in the obtainable condensation. Complete prevention of air leakage and collection of other gases in a condenser is impossible; hence some means must be provided for their removal. Today the steam jet air ejector is regarded as one of the most dependable and economical means known for removing undesirable gases from condensers.

TABLE I

PERMISSIBLE PRESSURE RISE FOR BACK PRESSURE VALVES

Rated pressure, psi gage	Permissible pressure rise above rated value, psi gage	
	When valve starts to open	When valve is fully open
0 to 4.99	7	12
5 to 10.99	8	13
11 to 38.99	11	16
39 to 70.99	20	30
71 to 99.99	25	35
100 to 149.99	30	45
150 to 199.99	35	55
200 to 249.99	40	65
250 to 299.99	50	80
300 to 349.99	55	90
350 to 399.99	65	105
400 to 449.99	75	120
450 to 499.99	80	130
500 to 549.99	90	145
550 to 599.99	95	155



Typical power plant steam jet air ejector has twin elements and a single shell for the inter- and after-condensers.

Principles

Simple operating principles of steam jet ejectors are well understood by most engineers. Fig. 1 shows graphically the pressure and velocity relationships existing during flow through an ejector. These curves are applicable to any stage of an ejector, provided the fact is recognized that each stage oper-

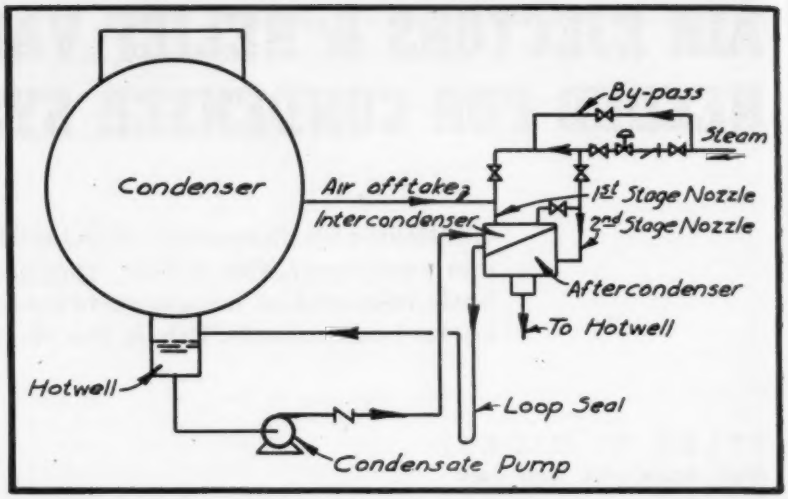


Fig. 2—Condensate from the condenser hotwell is utilized in the inter- and after-condenser for cooling the steam-air mixture.

ates at a different pressure.

Two-stage ejectors are the most common type installed in industrial power plant condensing systems. Such units may have either single or twin elements, according to the initial expenditure permissible for air removal equipment. In a single element unit, only one steam nozzle is employed in each stage, but two nozzles per stage are incorporated in twin element ejectors. Each nozzle has the full air removal capacity required for the system, and pressures down to 1 in. Hg absolute can be maintained by two-stage ejectors. Motive steam pressures usually range from about 70 to 350 psi, although higher pressures can be utilized if necessary.

Modern two-stage ejectors often combine the inter- and after-surface condensers in a single shell. Condensate is the cooling medium in both condensers, not only because a slightly better over-all plant heat balance is obtained but also because raw water is undesirable from the fouling standpoint. Recirculation of condensate to the main condenser hotwell is necessary during light loads to assure adequate cooling. Fig. 2 shows a typical piping arrangement for a two-stage ejector installed with an industrial power plant condenser.

Performance

Approximation of the most economical ejector capacity can be made from the curves in Fig. 3. Curves are valid for absolute pressures between 1 and 3.5 in. Hg absolute, as the ejector design pressure for this range has been established as 1 in. Hg absolute. Thus, an ejector for this condenser (31,800 lb of steam/hr) selected in Part I of this series would have to be able to handle 14.5 lb of dry-air leakage per hour. The ejector would consume 200 lb of steam per hour at a design capacity of 48.5 lb of air vapor mixture per hour. A unit selected for these conditions would be the most economical.

Ejector performance is, of course, based on well maintained and tight condensing systems. Air leaks around gage glasses, pump shafts, and valve stems can overload the ejector with a resultant decrease in efficiency and economy. Extensive experience with industrial power plant air removal equipment has shown that better economy is obtained by keeping the condensing system air-tight than by buying and operating an oversize ejector. Air ejector initial and operating costs increase with capacity. Hence, the most economical capacity ejector, in conjunction with a tight condenser, is the best assurance of low first and operating costs.

Important factors that affect steam air ejector performance include: (1) operating steam pressure, (2) steam quality, (3) back pressure, and (4) condensing water supply.

Too low a steam pressure at the ejector nozzle will always reduce operating efficiency considerably. Pressures between 50 and 70 psi cause a marked increase in steam consumption. If available, steam at a higher pressure should be employed to supply the motive force. Customary planning practice specifies the lowest steam pressure that will ever be encountered with the ejector, and, once the unit is

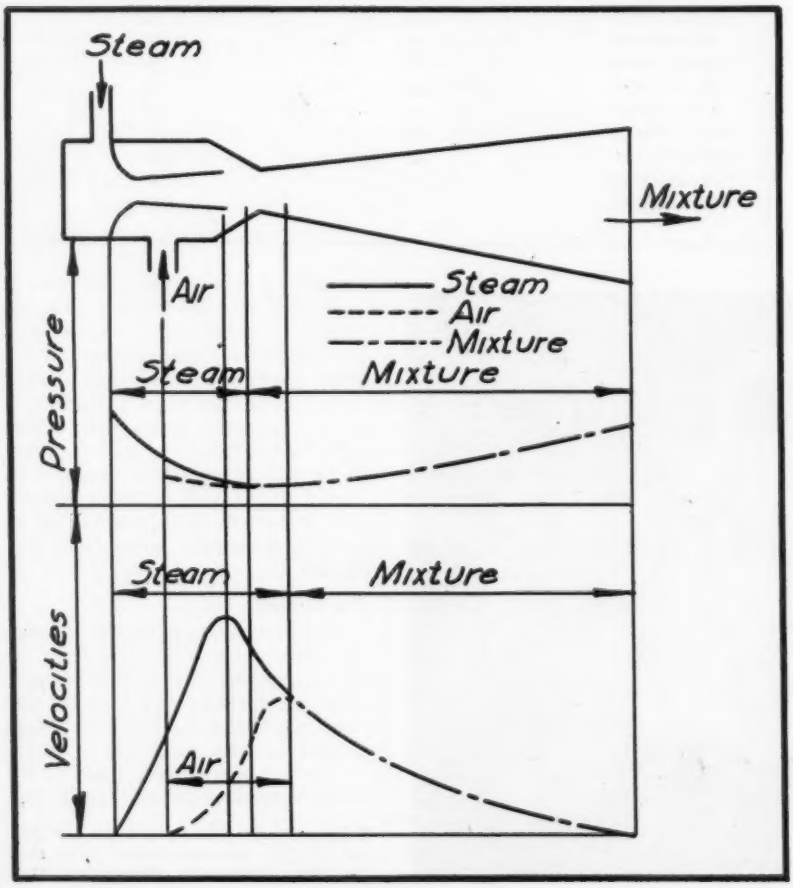
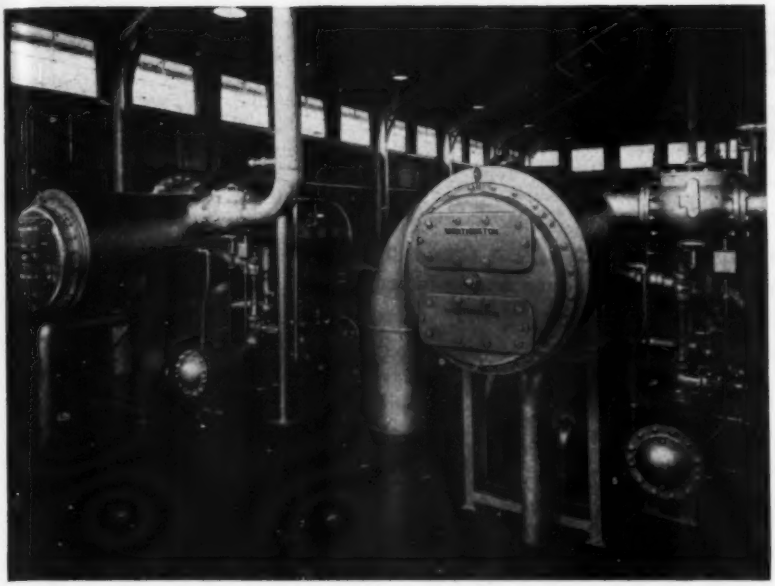


Fig. 1—Pressure and velocity relationship curves in an ejector show how initial steam energy is converted into velocity energy.



These condensers, with C. I. water boxes and Hotwell, are evacuated by double element single stage ejectors.

installed, daily checks should be made to see that proper pressure is maintained at all times.

Excessive steam pressures will also cause an increase in ejector steam consumption. The unit, however, will continue to operate satisfactorily with only a slight decrease in capacity. Increase of steam consumption is in direct proportion to the ratio of operating pressure to design pressure. Excessive pressure variation at the ejector inlet is prevented by the customary practice of installing a pressure regulating valve ahead of the inlet. Such an arrangement has a slightly higher first cost, but the savings in steam consumption is worthwhile.

Wet steam reduces ejector capacity and erodes nozzles and diffusers; consequently a slight degree of superheat in the ejector steam supply is desirable. In addition well insulated steam supply lines, together with an adequately sized separator in the line, help to prevent moisture entering the ejector. Extreme care is necessary to prevent moisture entering small capacity ejectors, because such sizes are more adversely affected by the moisture than are large units.

Normal design back pressure for power plant air ejectors is about 31 in. Hg absolute. Equipment suitable for back pressures up to 10 psi gage are available, but the steam consumption is considerably greater than standard ejectors. Increase of back pressure beyond the design value will produce a rise in steam consumption and the absolute pressure maintained in the condenser. To restore the condenser pressure to its normal value, the operating steam pressure must be increased, and this will cause a decrease in capacity as noted previously. The importance of maintaining the correct back pressure can therefore be readily appreciated.

Condensing water for inter- and after- condensers must be supplied at a pressure of about 5 psig. The maximum pressure that will be encountered must be specified to permit proper design of water boxes and tube sheets.

Most industrial power plant condensers are fitted with an atmospheric relief valve to protect the shell and turbine exhaust from excessive pressure when the vacuum is lost. Loss of vacuum can result from cooling water failure, operation of the vacuum breaker, increased air leakage, or sudden and complete tube sheet fouling.

Relief valves are required to pass all the steam which may reach the turbine exhaust. The maximum pressure rise permissible in the exhaust steam during the relieving period is 10 psig. Single or multiple-disk valves can be selected in accordance with the relieving capacity desired. Usual practice is to provide a "water seal" over the disks to prevent leakage of air into the condenser through the relief valve. Water flow to the seal is manually controlled and requires careful attention to assure an airtight joint.

All other outlets from industrial steam turbines, such as extraction openings, must also be protected with relief valves. The permissible pressure rise in these valves is usually higher than in atmospheric relief valves (Table 1). Relief valves are always connected in the piping between the turbine and the first shutoff valve—never beyond the shutoff. For automatic extraction turbines the design extraction pressure should be multiplied by 1.25 before utilizing Table 1. Relief valves are never supplied as part of the turbine; consequently special care is necessary when selecting them to make sure they are suitable for the particular installation.

Discussion in the three articles of the series have covered only the major items in modern condensing systems. A multitude of smaller items—such as piping, valves, thermometers, pressure and vacuum gages, and cleaning equipment—must also receive proper consideration by plant engineers and executives during system planning. Good planning is more than simply good practice; it is absolutely necessary to obtain a reliable plant that will furnish all steam and power required for industrial production.

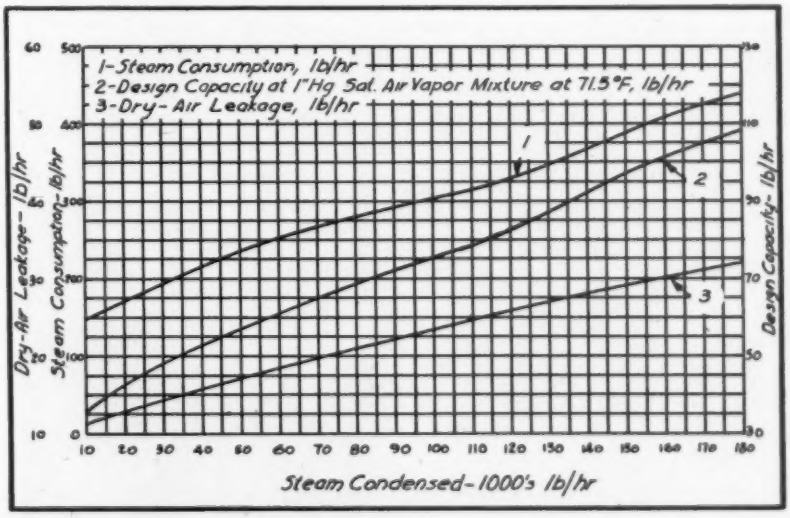


Fig. 3—Graph for determining the most economical capacity of steam jet air ejectors serving condensers operated between 1 and 3.5 in. Hg absolute.

GOSHEN'S 3200 HP DIESELS ALSO GENERATE STEAM

Two new engines are equipped with combination waste heat boilers and snubbers to recover heat of the exhaust, minimize noise, and increase over-all thermal efficiency. Oil preheaters, utilizing some of the recovered heat, will permit use of lower cost fuel. New cooling tower can handle 4000 gph.

MERLE J. MILLER, Superintendent of Utilities,
City Light and Water Works, Goshen, Indiana

ADDITION of two new 2 cycle 3200 hp Diesel units at Goshen, Indiana's power plant has not only increased the power capacity, but waste heat boilers reclaim heat from Diesel exhaust. Low pressure (0 to 3 psi) steam from these boilers is sufficient for heating the station in winter, as well as for heating a lube oil filtering system. Steam also will be utilized to heat fuel oil, when an oil heater is installed. This will permit purchasing No. 4 oil instead of the No. 3 fuel now burned.

Formerly, the station's older units—three of 900 hp each and one 1400 hp Diesel engine-generator—were handling 75% of all commercial and residential service plus 35% of the city's industrial power needs. The remainder of the energy required was purchased from a private utility company. The new units were installed to eliminate the purchased power and to prepare for expected growth in the demand for electrical energy.

Both new Diesels, in this expansion program, are eight cylinder, mechanical injection units, and when operated at 225 rpm they are capable of developing 3200 hp. Each unit is direct connected to a 3125 kva alternator, which generates 4160 volt, 60 cycle, 3 phase current. Field current is supplied by individual 40 kw, 125 volt d-c exciters, chain connected to the main drive shaft and operated at 1150 rpm.

Heat Recovery

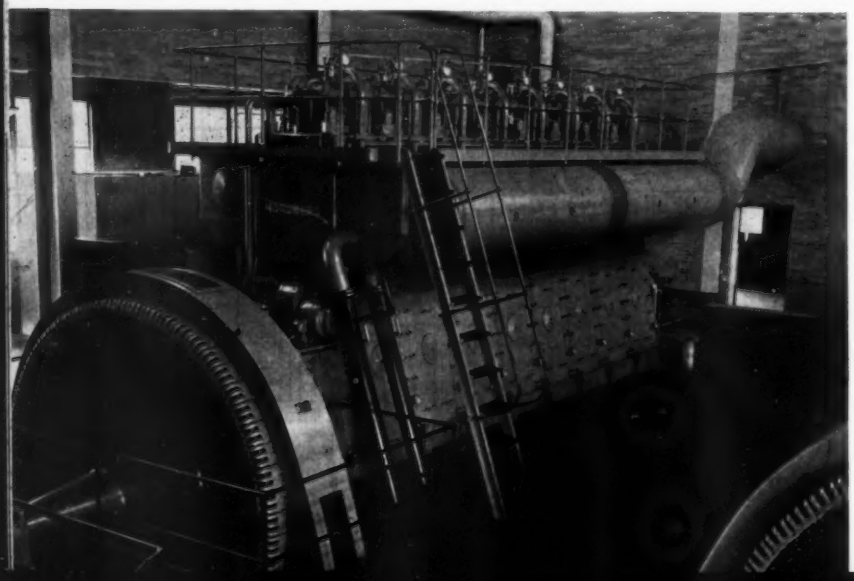
Each Diesel has a separate exhaust system and waste heat boiler. The exhaust gases flow through a net work of tubes and give up Diesel combustion heat to the boiler water, before passing noiselessly to the atmosphere. Operational plans call for either one or both of the new Diesels to be on line at all times, so steam can be generated during the summer months.

Steam generation, during low load periods, is limited by varying the boiler water level. A feedwater pump runs continuously and at low steam demand a spill control valve returns excess water to a zeolite storage tank. As the steam demand increases, the spill valve closes, thus raising the boiler water level. Both waste heat boilers are protected by means of a flue gas control. If a fire occurs in the boiler, the water level is automatically raised. High steam pressure is relieved during low demand periods by venting steam through relief valves.

Steam furnished to the lube oil filter system is slight, and for this reason the condensate is wasted. However, all the condensate from the station's heating system, during the winter, is returned to the boiler. Make-up water, when required, is obtained from the zeolite storage tank.

Storage

All Diesels, at the present time operate on unheated No. 3 fuel oil. However, arrangements are already underway to change over to No. 4 fuel oil. The new fuel, in addition to being preheated to 140° F, will be run through a centrifuge before it is discharged into the ignition chamber. Fuel oil can be either trucked in or received by rail in tank cars. Unloading is at a conveniently located truck ramp or railroad spur. Bulk storage is accommodated in three 20,000 gal horizontal tanks, one 60,000 gal vertical tank, and two newly installed 100,000 gal tanks, all of which are above ground. Day storage is limited by city code to four 275 gal tanks located in the basement.



One of the two new 3200 hp Diesel generators recently placed on line. Large exhaust duct connect to waste heat boiler in adjacent room.

Scavenger Air

Two scavenger air systems—one for each Diesel—consist of inlet air stacks, automatic and continuous oil bath air filters, and turbine blowers. The blowers are direct connected to 250 hp 3500 rpm 3 phase induction motors, and the rated capacity of each unit is 1500 cfm at 2.75 psi. The blowers operate only when their companion Diesel engines are on line.

Alarm

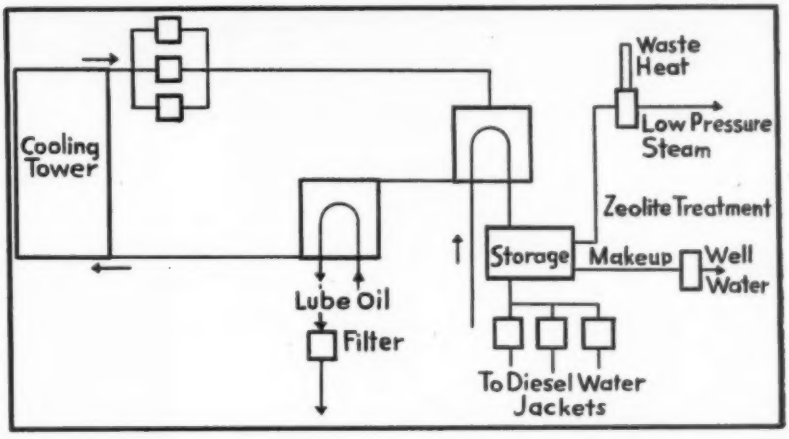
Individual alarm systems are incorporated for both new Diesels. A warning horn sounds when the lube oil level is low, when the fuel oil level in the day storage tanks is low, or when oil or water temperatures are excessively high. Diesel speed is controlled by an overspeed trip, which automatically moves the fuel regulator shaft and limits fuel flow to the cylinders.

Cooling Water

One new water cooling tower has been installed capable of handling a maximum of 4000 gph. The tower was designed to have a temperature differential of 14° F during extreme summer weather conditions. Three circulating pumps discharge chilled water from the tower to a jacket water heat exchanger. The jacket cooling system is completely enclosed, and the zeolite treated water is circulated by three pumps—two electrically driven and one gasoline motor driven. At present the four old Diesel engine jackets are cooled by water pumped from a creek adjacent to the plant, but, as time permits, they will be tied into the new treated water cooling system.

After picking up heat in the jacket water heat exchanger, the cooling tower water flows through a lube oil heat exchanger and is returned to the tower. Lube oil, in addition to containing heat picked up in the Diesel crankcase, is heated in one of four fuller earth packed filters to 130° F during the filtering process. This hot oil is cooled and then pumped to an oil header in the crank case of each Diesel.

Cylinder lube oil, since it contains burned particles of carbon, is separated from the main crankcase lube system. After lubricating and flushing the cylinder and rings in the piston, the oil flows to a settling tank, and the large pieces of carbon are removed. This oil is drawn off and pumped through one of the four oil filters, filtered then stored in a clean oil storage tank until needed. Forced feed pumps located on the side of the Diesel supply oil under pressure to individual cylinders.



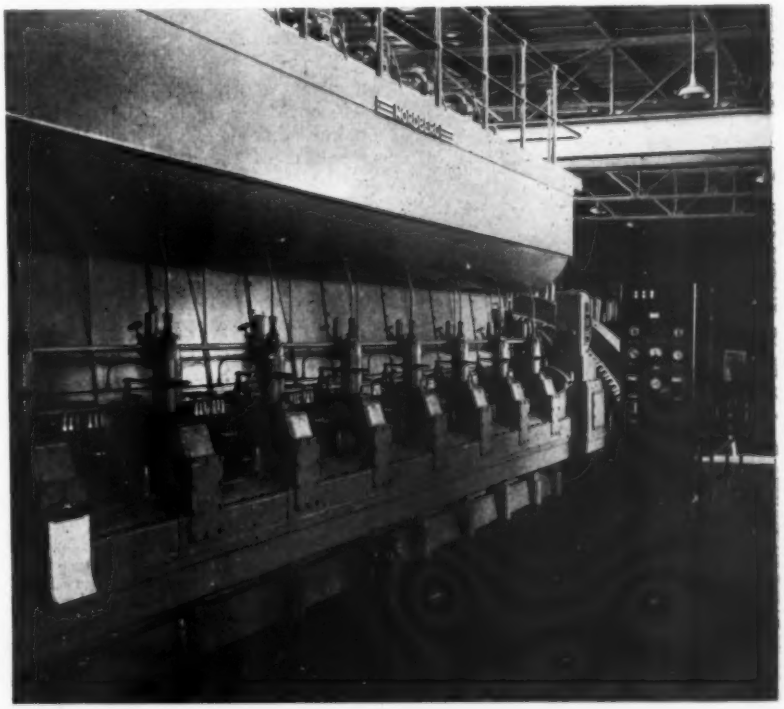
Starting Air

Compressed air for starting the Diesels is supplied by three air compressors—two electric operated and one gasoline engine driven—at a constant operating pressure of 250 psi. The air necessary for general shop service is stepped down by means of reduction valves to approximately 60 to 80 psi. The two electrically driven units operate on 440 volt 60 cycle, 3 phase current, and the 10 bph gasoline driven unit is available as an emergency standby.

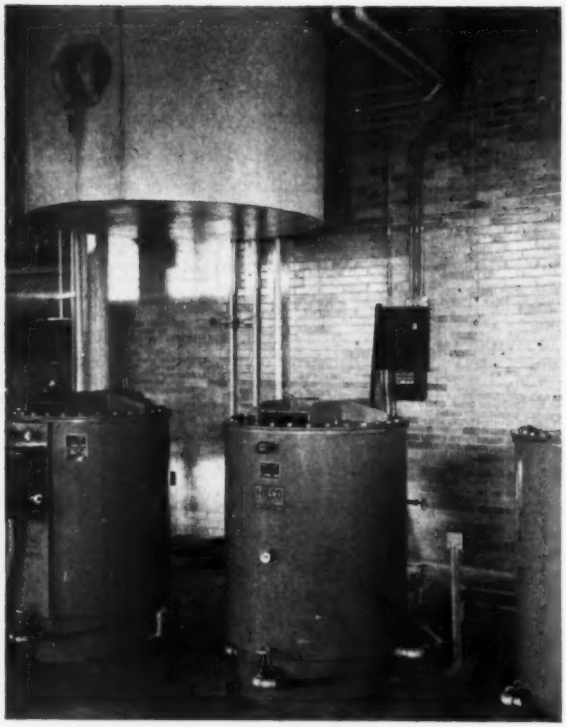
Power Distribution

Six new cubicles have been added, that contain switch-gear operated by air breaks rated at 1200 amps with an interrupting capacity of 100,000 kva. These new units were placed in an especially built bay, adjacent to the new Diesels. Power for commercial service and plant usage is transmitted at 4160 volts. For plant service the voltage is stepped down to 220 volts, which is the voltage required for all auxiliary electrical equipment.

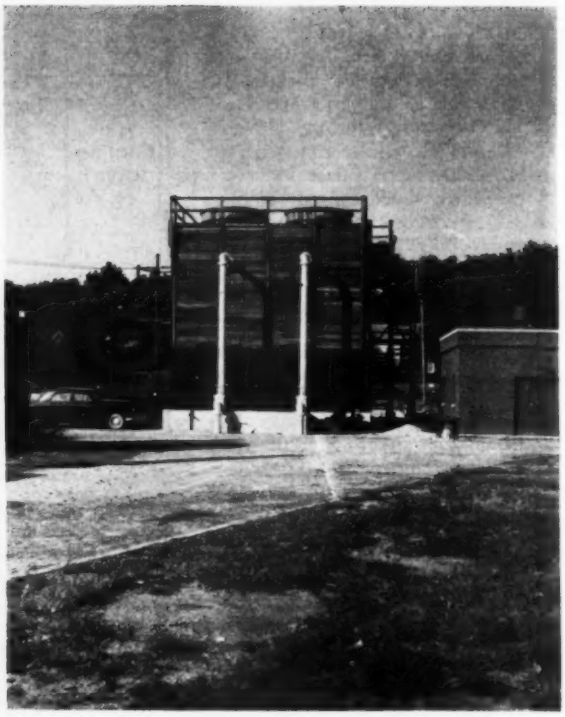
Vibration damping for the new Diesels was not considered necessary



Individual forced feed pumps furnish lube oil to the piston rings. Air operated engine starting equipment is located to the left of Diesel control panel.



Lube oil is reconditioned in these fuller earth filled filters. Drum in upper left is the lower portion of one waste heat boiler.



Cooling towers are capable of furnishing 4000 gph of water to cool the engine jackets and lube oil for the new Diesels.

because the new building is entirely isolated from the original one by expansion and contraction joints. However, piles were driven into the ground and a heavy mat of concrete was placed before the foundations, supporting the Diesels, were laid. In effect this type of floating construction acts as a vibration base, and little or no vibration is detectable, even when both units are operating at capacity.

In all ¾ million dollars were expended to complete this latest addition. The first installation consisted of three 900 hp Diesels and was made in 1931 to replace a worn out and obsolete steam generating system. Later in 1946 one 1400 hp Diesel was placed on line adjacent to the original units. Operation of the new and old units will be flexible, and any combination of units can be placed on line to meet peak and low load conditions. The present operating personnel consists of a chief engineer, four operators, and five helpers, who work staggered shifts on a 40 hour week basis.

Pumping Station

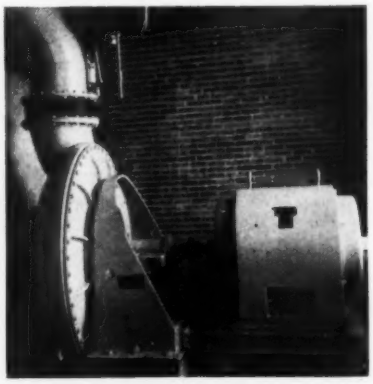
In addition to supplying electrical power, the Goshen plant furnishes well water to the City and environs. Water is pumped from eight, 175 to 190 ft, wells, adjacent to the plant, by vertical 500 gpm capacity pumps. Each pump is direct connected to a 50 hp, 440 volt motor. A 240 hp engine driven pump can be placed into operation at a moments notice as a standby. All water is stored in a 500,000 gal elevated tank and a 278,000 gal capacity standpipe.

(Right) High pressure direct connected centrifugal blower, rotating at 3500 rpm, delivers 1500 cfm of scavenging air at 275 psi.

(Left) Air for scavenging is drawn through start intake stack and later discharged from the waste heat boiler.

PRINCIPAL EQUIPMENT

Diesel—Nordberg Mfg. Co.
Generator—Elliott Co.
D-C exciter—Elliott Co.
Scavenger air blower—Elliott Co.
Scavenger air blower motor—Elliott Co.
Scavenger air oil filter—American Air Filter Co., Inc.
Alarm—Nordberg Mfg. Co.
Cooling Tower—J. F. Pritchard and Co.
Water Pump—Ingersoll-Rand Co.
Water pump motor—General Electric Co.
Waste heat boiler—Burgess-Manning Co.
Oil filter—The Hilliard Corporation
Switch Gear—General Electric Co.
Lube oil feed—Manzel Inc.
Controls—Barber-Colman Company
Governor—Nordberg Mfg. Co.
Heat Exchangers—Struthers-Wells Corp.
Temperature Indicator—Alnor Instrument & Pyrometer Co.



WELDED ECONOMIZER TUBE RETURNS INCREASE EFFICIENCY

Welded return bends in economizers offer many advantages when make-up water has been properly treated. The author discusses the installation of these tube turns, how they reduce maintenance costs and increase overall efficiency.

CARL McLAUGHLIN,
Engineering Service Department, Tube Turns, Inc.

IN recent years considerable money has been spent on the maintenance of economizer tube returns. This resulted from poor methods of treating feed water and the consequent failure of the packing between the tube return flanges.

Previously there was no satisfactory remedy for the problem brought about by leakage of tubes at the joints. Impurities in the feed water caused scale to form on the insides of the tubes and impaired their usefulness. However, conventional connections have made mechanical cleaning possible, whenever conditions warrant the labor involved.

Today with the improved treatment of feed water, the deposits of impurities in economizer tubes have been reduced, thus eliminating, in most instances, both the need for periodic interior cleaning and the need for the troublesome flanged joints or header boxes. The purity of feed water now solves the vexing problem of tube cleaning and leakage, which has for so long plagued plant engineers. Furthermore, the mechanical joints can be discarded and the tube assembly re-fabricated with 180° welding fittings. Properly welded, the tubes are then permanently leak-proof, and, in addition, provide optimum flow conditions. Welded lines, equipped with forged welding fittings, can replace inadequate connections where critical factors are involved.

Generally speaking an economizer, when reclaiming heat from flue gases to heat feed water, increases the boiler efficiency 1% for every 10° the feed water temperature is raised. Under favorable conditions, fuel bills may be lowered from 7 to 20%. In addition, an economizer decreases boiler stresses by reducing thermal shock (expansion and contraction), since the feed water enters at temperatures more nearly equal to that of the boiler drum. It also provides an amount of hot water storage, which better enables the boiler to meet sudden peak demands.

Two types of fuel economizers are available. The first type is an integral part of the boiler and has been in existence for a decade or more in large central stations. The other type is independent of the boiler and was introduced about 1900. Between 1900-1940 a vast number of power plants expanded, and the independent type of economizer was more widely installed. However, at the present time the integral type is preferred.

Fuel economizers of the independent type are typical for the 150 to 300 psi boiler and consist of tubes with the correct diameter, wall thickness, and length required for the service. The tubes are arranged in banks, from 32 to 800, and they are positioned so that the hot gases from the boiler sweep over them en route to the stack. Water enters the economizer at an initial tem-

Fig. 1—Tubes were pulled from economizer and one end arc welded at the floor level. The assembly was then replaced and the opposite tube ends were welded to companion fittings.

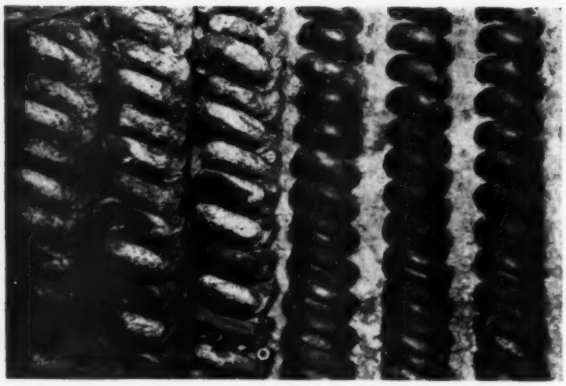


Fig. 2—First three rows of tubes show the 180° welding fittings already fabricated in the economizer. Second three rows are still the original flanged bends that were being replaced.

perature of approximately 210° F. and leaves at a possible maximum temperature of 400°F. The tubes are usually subjected to 700 to 1000 psi in hydrostatic tests, which is well above the normal operating pressure range of 150 to 300 psi. The temperature of the metal in the tubes may range from 200° to 650°F.

Directional Changes

Directional changes in the tubes are ordinarily made with U-bends or header boxes. When the first method is employed, the tubes are upset, faced, and fitted with companion flanges. A thin gasket is placed between the flanges and the assembly is held together by two bolts. Costly leakage can develop at the flanged joints, or at the header boxes. Repairs are inconvenient to make and sometimes entail expensive shutdowns, which add to the maintenance overhead.

Savings

One example of the impressive savings brought about by a change over from flanged bends to 180° welding fittings is demonstrated by a large public utility's midwest power plant. Operating equipment consisted of eight boilers and eight independent economizers of 4300 sq. ft. each. After the tubes had been refabricated with forged welding fittings, the maintenance cost was apparently cut approximately $7500 per year. In addition, as a result of full economizer availability, a substantial amount was saved annually in operating cost. Cost of modernizing each economizer was $12,500, including all materials and labor; and the investment, therefore, has been amortized in a relatively short period. Furthermore, this company has re-fabricated the economizer tubing in two other plants operated by subsidiaries.

Each of the eight independent type fuel economizers consists of 200 2-in. outside-diameter tubes with a wall thickness of 3/8 in. Eight hundred 180° return bends, with 5-1/2 in. centers, were required for directional changes in each economizer's tubing, or a total of 6400 for the eight units.

Procedure for welding the 180° fittings to the individual lengths of the disassembled tubing was relatively simple. Half of the work was done at floor level. (Fig. 1) Individual lengths were joined at one end and set in the unit, then the opposite ends were connected with 180° fittings. The outside row of tubing was fabricated first and progressed in sequence toward the center rows.

Procedure

When originally installed, the tubing lengths had about 4 in. of longitudinal play between the two tube sheets, to allow for wrench room and servicing. For this reason, the tubes could be pulled through the tube sheet as far as possible, welded, and returned to their normal positions. Fitting rings assisted in aligning the tubes in the apertures of the tube sheets after the welding operation.

Arc Welding

Metallic arc method of welding was employed in this particular installation as the tubing was relatively heavy. The first pass was made with a 1/8-in. rod. The three or four subsequent passes were made with either 1/8-in. or 5/32-in. rods, whichever the welders preferred. In some instances the welding was facilitated by utilizing groove type welding rings with knock-off spacer pins. When the tubing is of lighter gage and the work area tight, as is the case in some economizers, the acetylene welding method can be advantageously employed.

After the welding job was completed, the fitting rings were packed in asbestos cement, and the tube sheet was given a coat of cement. The doors were replaced, and the economizer was ready for service.

Welders completed 24 welds per day on the tube ends fabricated at floor level, and 16 welds per day on the tube ends after the tubes were restored to position. The time involved included fitting up, moving tools, equipment, and incidentals; and at 16 welds per day, the cost was only $1.25 per weld.

Many marked advantages are obtained by installing forged welding fittings in the fabrication of economizer tubing and other industrial piping. Uniform wall thickness provides maximum strength. The pipe bends can be cut at odd angles and readily joined to pipe of corresponding size. Space and fabricating time are saved, and maintenance cost is minimized. Solid, permanently leakproof joints can represent a long-range investment.

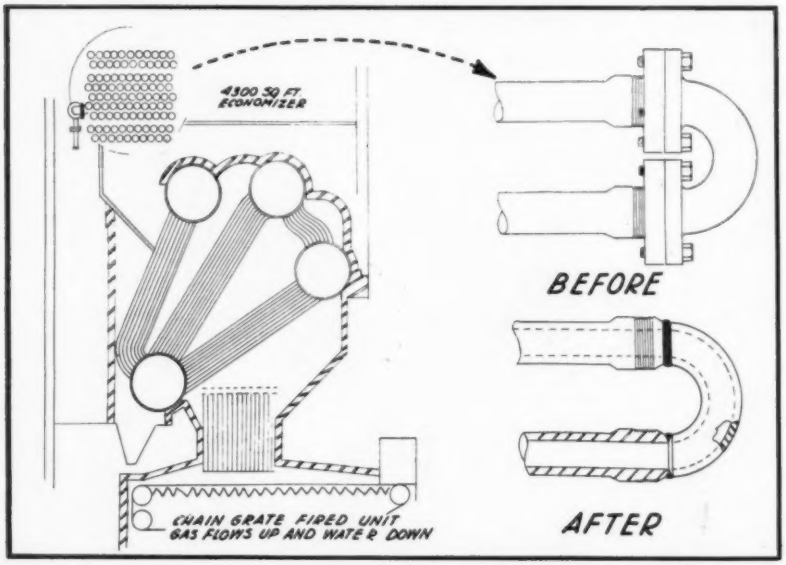


Fig. 3—Field application of the 180° welding fittings illustrates how the economizer tubing is prepared before welding by beveling the tube ends.

LOOPS, SLIP JOINTS, AND BELLOWS COPE WITH PIPE EXPANSION

Stresses set up by pipe expansion and various devices for relieving them — particularly loops, slip joints, and corrugated bellows — are discussed. Figures and examples are cited to show economy when expansion joints eliminate excess piping.

B. MADDOCK,
Western Editor

CHANGES in temperature of piping systems from day to night, from full operation to stand-by, from winter to summer, are accompanied by corresponding shrinkage or elongation of the system as the case may be.

As long as the temperature changes are small and the length of straight runs are short, the expansion is of little consequence. This is true—even though stresses do exist—because the end positions or terminals are not as rigid as generally assumed. For example, a straight piece of 4 in. pipe 10 ft long, which has a 50° F temperature rise, should expand approximately 0.04 of an in. If completely restrained, the pipe would have a stress equivalent to 9000 psi compression. Since a 4 in. schedule 40 pipe has a cross-section of 3.174 sq in. of metal, the total force exerted against the end connection, Fig. 1, would be about 28,000 lb. Fortunately, many things can happen to prevent such a force from being transmitted, viz: (1) stress deformation in the pipe tends to bow the pipe; (2) gaskets may give slightly; (3) anchors do not hold the pipe rigid; and (4) pipe may have been in tension at the original temperature and thus part of the expansion due to heat would only tend to relieve the initial stress.

In any event the full expansion force is seldom realized, but as the ratio of length to "give" increases, pipe stresses become more and more of a problem. The deformation by compression of a gasket might relieve the stress on a 10 ft length of pipe but certainly could not be counted on to ease the stress resulting from a 100 ft piece going through the same temperature change.

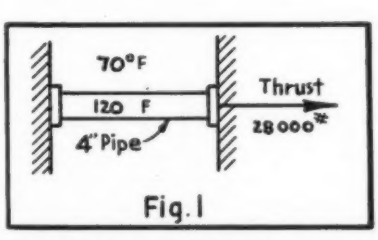


Fig. 1

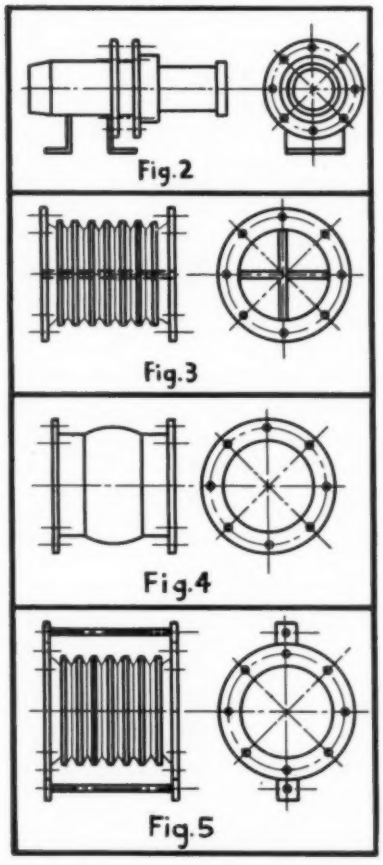


Fig. 2

Fig. 3

Fig. 4

Fig. 5

Likewise the stresses set up by a 50° F rise are of minor importance compared to those encountered at temperature changes of 500° F and above. An absolutely rigidly anchored pipe will not be over-stressed by expansion forces until after the temperature change has exceeded 200° F. Oddly enough, the length of run has no bearing whatsoever on the unit metal stress in pipe between solidly fixed supports. Unit metal stress is merely a function of temperature, coefficient of the expansion, and modulus of elasticity. Neither does the diameter of the pipe have any influence on the unit stresses set up, but the diameter and wall thickness are reflected in the amount of total force exerted against an anchor or terminal.

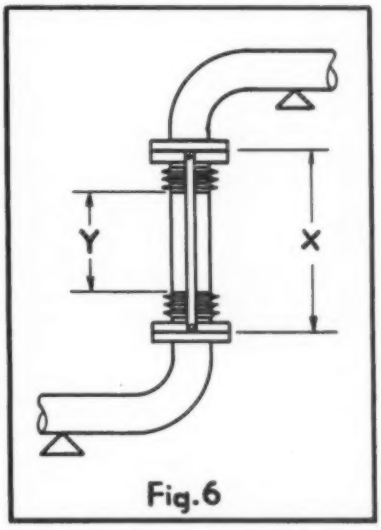


Fig. 6

Of course additional problems may be introduced when the pressure inside the line is considered. Any deformation or offset which is set up by thermal conditions, as well as by the pressure in the pipe, produces moments and torques great enough to cause leaky gaskets, undesirable strains on valves and equipment, or even breakage of fittings.

Equipment

Allowances for expansion can be made by changing planes (that is, adding coils, bends, loops) inserting slip-joints, or utilizing corrugated bellows type fittings. Here again pipe

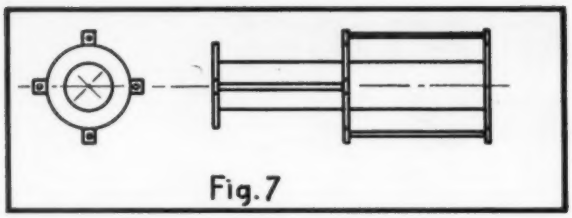


Fig. 7

moments are encountered. On low-pressure steam, the slip joint, Fig. 2, and copper corrugated bellows, Fig. 3, have been popular choices of design engineers. Hot water, air, and low temperature fluid pipe lines frequently are equipped with rubber type expansion joints, Fig. 4.

High pressure, high temperature steam presents a problem, because the values of the factors causing expansion are higher, the pressure adds to the stresses, and the high temperature weakens the material. Thus the net allowable design stress due to expansion is greatly reduced. In order to compensate for these factors, engineers have resorted to long pipe bends, hairpin loops, and full circles. Few high pressure systems are being installed today that do not have at least one loop plus a "run" in all three planes. Every effort is made to use both torsion and bending moments to relieve end reactions and the maximum stress. Some of the best data for applications of bends and loops comes from manufacturers' catalogs.

Thrusts

The old geometrical axiom about the straight line being the shortest distance between two points is still good. Unfortunately, however, as has been explained, in piping systems the end reactions or thrusts may become too great with such simple runs, so a devious route has to be found to reduce the strain. This is akin to making a road take a long slope up a mountain rather than going directly up the side. But conveying high temperature steam and some hot fluids require high cost pipe material. Therefore, in the interest of economy, the lines are made as short as practical. "Tortuous" paths—which add considerably to the pressure drop, cost of pipe, heat losses, and loss in available energy—should be reduced to the minimum.

Any added length of piping is a direct installation charge and is easily recognized, but the amortized heat loss may be even a larger figure. For example, 100 ft of 8 in. schedule 80 pipe may be had for about $250. This same pipe carrying 800° F steam and covered with 3 in. of insulation will lose between $150 and $200 worth of heat per year. Thus, on heat saving alone, a capital investment of $1500 to $2000 could be justified for eliminating each 100 ft of pipe involved.

Design of piping systems based on 1% drop per 100 ft is not an uncommon practice. Nevertheless, a 1% pressure drop for steam on its way to a high pressure turbine can cut the efficiency 0.3 of 1%. This is a $370 a year loss for a 20,000 kw steam plant or the equivalent of a $4,000 to $5,000 investment that can be amortized by reducing the pipe run 100 ft.

Design

All of these figures and examples are cited to show that considerations and time spent in designing piping systems free of excess piping can be justified. This is true even without taking into account the more convenient layout, reduced engineering expense, and general appearance of the finished installation.

As one choice, a slip type joint (Fig. 2) can be considered. Expansion with this joint is compensated by retraction of the sliding sleeve, and contraction is met by extension of the sliding member. Anchors are installed to resist the pressure in the pipe line, which tends to pull the sliding sleeve out of the joint, as well as to oppose the frictional resistance in the stuffing box and pipe line supports. Limit stops too are provided, in some cases, so the sleeve cannot be pulled out, should an anchor give way. A smooth surface on the sliding element is required if the packing joint is to remain tight. Also the sliding sleeve must be guided centrally through the packing gland, and similarly guides for the pipe line leading into the joint are desirable. Investigation shows that long travel can be accommodated but that axial misalignment (bending) at the joint can not be tolerated. Neither can unsupported bends be employed, as the pipe would tend to "blow" out. In addition the tendency to pull apart at unanchored ells increases the bending moment in the connecting piping and aggravates the high stress condition.

The corrugated bellows type of joint (Fig. 3) will take some axial misalignment but it is limited in total travel. Also it has the tendency to spread when placed between unanchored ells. Neither the slip joint nor the corrugated joint is designed for use at high pressure and temperature where the end connections are in different planes or elevations, unless restrainers are incorporated.

Restrainers

One way of limiting the transfer of internal pipe pressure to bending stress at the unsupported bends is to restrain the expansion piece by yokes. However, this tends to defeat the purpose of the joint, for the internal pressure tries to force the joint "open".

Yet the restrainers have their good points, and since they do not eliminate the possible angular movement in the piping system, a unit can be designed to relieve the bending entirely by angular displacement. This permits the designer to choose the fewest number of corrugations in the patterns which the vendor supplies, as the total expansion is resolved to angles rather than axial movement. In addition the bellows joint is not repeatedly stressed through deformation and chances of failure are reduced. If a restrainer is applied, it also prevents "jet action" in case of rupture of the bellows.

Optimum design would allow hinge action without allowing axial elongation. In the case of low velocities and end pressures, such action can be accomplished by the use of a single rod as

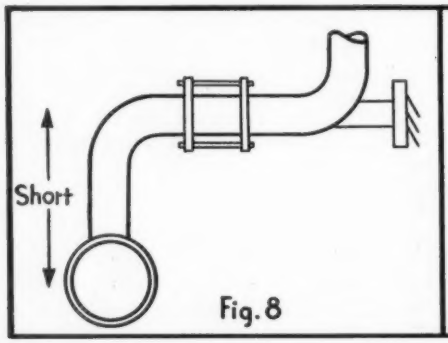


Fig. 8

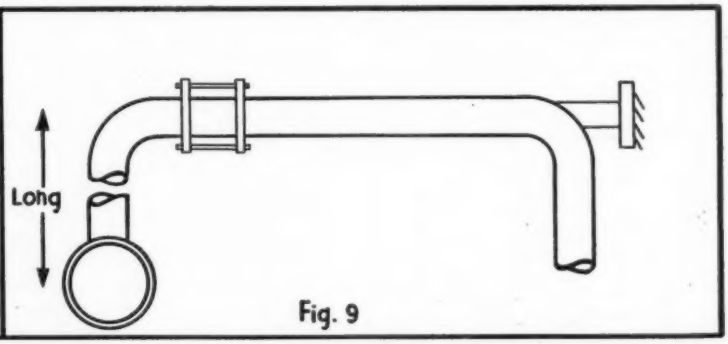


Fig. 9

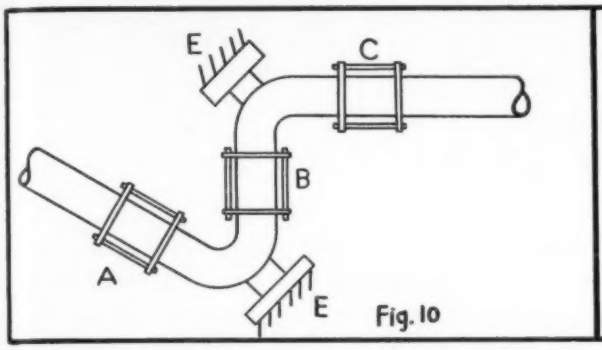


Fig. 10

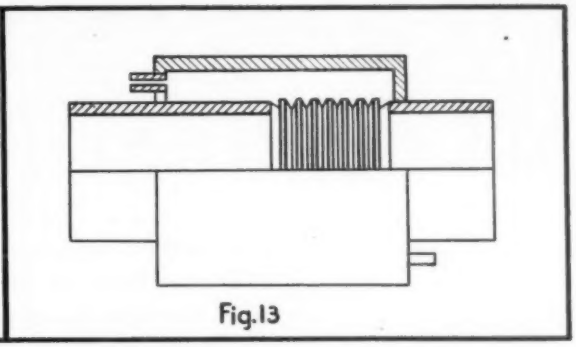


Fig. 13

shown in Fig. 3. This makes a neat appearing joint which offers the most flexibility and is suitable when the single rod can be made strong enough to take the axial strains caused by the internal pressure tending to "open" the joint.

Single hinging can be provided by diametrically opposed restrainer rods. These rods may be threaded on both ends and used as studs at the flanges. Of course the rod, Fig. 5, has to bend through the angle of displacement but this is usually of minor significance.

Swing joints (Fig. 6) are an adaptation of offset type joints. The principle difference being that the face-to-face dimension (X of Fig. 6) remains practically constant during operation even though the "Y" length expands or contracts due to temperature changes. As illustrated a pair of tie bars, pivoted at each end and installed 180 degrees apart, is attached to the end flanges. When swing joints are provided with weld-end connections, a flange plate of a diameter larger than the bellows is welded around the pipe a short distance from each end to provide a support for the pivot points and distribute the thrust over the entire pipe area. The bars and pivot suspensions are designed of sufficient strength to counteract the thrust force created by the operating pressure acting on the bellows area. Consequently they serve as self contained anchor points to eliminate over-travel of the bellows and yet allow the joints to swing.

Swing joints may be advantageously employed for the following classes of installations:

1—Overhead systems, either indoor or outdoor, where the placement of anchors is not practical in the major run due to lack of sufficient mounting points

2—"Dog-leg" pipe sections where space economy and convenience are required and where the application of standard expansion joints would present installation problems

3—Turbine pipe connections where thrusts approaching a "zero-zero" condition are the desirable ultimate

4—Where pipe noises would be concentrated locally as the result of being transmitted through rigid anchors in the immediate vicinity.

Double or universal hinging, similar to that obtained from the center rod, can be accomplished by arranging the bolts as shown in Fig. 7. The yoke ring has to be made strong enough to withstand the axial stress.

When the end thrust from internal pressure is not great (that is, on a large low pressure line or a small high pressure line), restrainers may not be necessary—whether they are or not depending upon the spring rate of the bellows. They may not be required for short risers, such as shown by Fig. 8, provided the end thrusts can be taken by the piping arrangement. But, short or long risers, restrainers must be provided if the force exerted by the pressure within the pipe exceeds the spring rate force of the bellows. Unless a number of similar outlets try to turn the header in the same direction, the moment can be resisted sometimes by the header. However, with higher pressures and longer risers, the resistance becomes less and anchors and guides are advisable, as indicated in Fig. 9.

Axial Movement

Since the restrained or yoked corrugated hinge cannot take axial movement, each leg has to have at least one such device.

Also, when one leg is particularly short, the angle of deflection may become larger than may be practical. The extreme of this case is shown in Fig. 10, but the system could be made flexible by merely removing the yokes and using the conventional slip joint or corrugated bellows—provided sufficient anchorage is supplied.

Customary design decrees that piping shall run parallel or perpendicular to walls or floors. Contrasts to such arrangements are indicated by the comparative sketches, Fig. 11 and 12. In each case the pipe is not overstressed, but the pipe run in Fig. 12 is greatly reduced, fewer bends are employed, and pipe runs are simplified. Consequently the heat losses will be less.

Objections

Some engineers regard expansion joints as introducing a point of weakness in the line. They contend that a pipe wall thickness may be calculated to be ½ or ¾ in. and yet corrugated

(Continued on page 119)

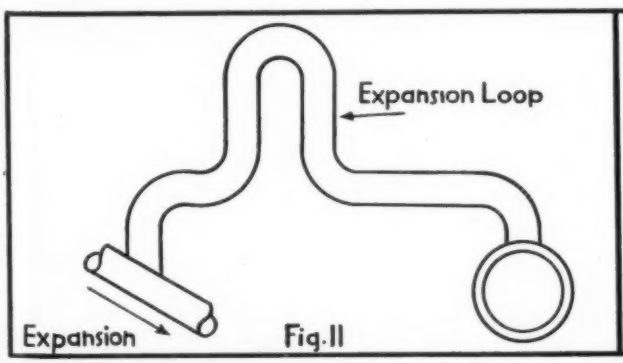


Fig. 11

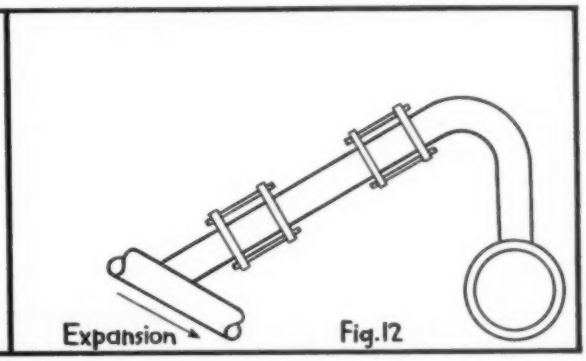


Fig. 12

MAINTAINED CONTROLLERS MEAN MORE EFFICIENT OPERATION

This author supplies numerous timely tips on how to obtain the most satisfactory service and maximum life from control apparatus for electrical equipment. Items to be checked at periodical inspections and semi-annual overhauls are covered in detail.

THOMAS TRAIL, Technical Correspondent

MAINTENANCE of control apparatus is essential to keep motor-driven equipment operating at peak capacity and to eliminate unexpected breakdowns. This necessitates a well-planned system of inspection, upkeep, and repair. Such a program should be based on the type of control, frequency of operation, and the conditions under which it operates.

In general some type of record must be kept of all maintenance procedures to prevent neglect of control devices. One convenient method is by means of a wall chart as shown in Fig. 1. This chart lists machine numbers, controller numbers, frequency of inspections, cleaning, lubrication, and other details, such as repairs. The provision for inclusion of the date and initials of the workman serves as a responsibility check.

Another important fundamental of a sound maintenance program is that a sufficient quantity of spare parts should be kept on hand at all times to take care of replacements of worn or damaged parts. Naturally those parts which are subject to more rapid repair than others—for instance, contact tips and some types of flexible shunts—should be stocked in larger quantities than the less frequently needed parts. Although they are not required too often, such parts as springs, coils and resistors are also essential standbys. Of course the quantity of spare parts (or complete standby units) necessary to provide an adequate supply will vary in accordance with the importance of the control and the number and variety of types in service. To facilitate the ordering of spare parts, complete parts lists should be on hand for all control apparatus.

An efficient inventory system for stocking spare parts is an asset to any plant's stores department. A streamlined method popular in many companies consists of numbered containers for spare parts; an alphabetical parts chart on which the container numbers are entered; and a small card in each container giving the part catalog number, minimum quantity to be kept on hand, and actual quantity in stock. Record of the quantity on hand should be changed every time parts are removed from a container or the supply is replenished.

Index cards are also a convenient means of keeping a permanent record of repairs and replacements made on the control apparatus. Each control device should be assigned a separate card, bearing the same number as the device, and the cards filed numerically for convenient reference. Checks of the performance of any control apparatus over a period of time is then a simple matter.

To achieve maximum efficiency, a maintenance program should have as its goal prevention of unnecessary service interruptions, proper operation of equipment, and minimum downtime when trouble occurs. The first two of these aims can be realized through intelligent and thorough inspections and the last one can be accomplished only through an understanding of the operation of each type of control. The latter aim necessitates study of manufacturers' instructions, wiring prints, and actual observation of all the functions of each type of control

MOTOR CONTROL MAINTENANCE

MACH. NO.	CONTROL DEVICE NO.	CLEANED		INSPECTED		LUBRICATED		SEMI-ANNUAL INSPECTION		REMARKS
1	1	10-6-48	RW	10-6-48	RW			6-24-48	SR	
1	2	10-6-48	RW	10-6-48	RW			6-24-48	SR	
2	3	10-6-48	RW	10-6-48	RW			6-24-48	SR	RENEWED 2 SHUNTS
2	4	10-6-48	RW	10-6-48	RW	10-6-48	RW	6-24-48	SR	
2	5	10-6-48	RW	10-6-48	RW			6-24-48	SR	
3	6	10-7-48	RW	10-7-48	RW			6-30-48	SR	
3	7	10-7-48	RW	10-7-48	RW			6-30-48	SR	
3	8			10-7-48	RW	10-7-48	RW	6-30-48	SR	
3	9			10-7-48	RW			6-30-48	SR	
4	10	10-10-48	WH	10-10-48	WH			6-30-48	SR	
4	11			10-10-48	WH			6-30-48	SR	RENEWED CONTACTS
5	12	10-12-48	WH	10-12-48	WH			7-5-48	ST	
5	13			10-12-48	WH			7-5-48	ST	
5	14			10-12-48	WH	10-12-48	WH	7-5-48	ST	
6	15	10-12-48	WH	10-12-48	WH			7-5-48	ST	
5	16			10-12-48	WH			7-5-48	ST	Adjusted Timer
6	17			10-16-48	WH	10-16-48	WH	7-6-48	SR	
6	18	10-16-48	WH	10-16-48	WH			7-6-48	SR	
6	19			10-16-48	WH			7-6-48	SR	
7	20			10-20-48	WH			7-17-48	SR	
7	21	10-20-48	RW	10-20-48	RW	10-20-48	RW	7-17-48	SR	
7	22			10-20-48	RW			7-17-48	SR	

Fig. 1—Detailed maintenance records minimize chances for neglect of equipment.

Contacts are probably the most vulnerable part of controllers and require continuous maintenance.

when in normal operation. All instructional material should be carefully filed for quick reference and protection. Working prints can be covered with transparent protective material, or additional copies may be kept in stock for replacement. Any apparatus information not on hand should be obtained from the manufacturer.

Wherever possible, simplified or "straight line" wiring diagrams should be used for maintenance and trouble shooting. When such elementary diagrams cannot be obtained from the control apparatus maker, substitutes may be prepared from conventional type prints.

In order to fully understand simplified wiring diagrams, maintenance men should be familiar with the symbols employed to represent various devices and parts of the circuits. Accompanying chart shows the more frequently used standard symbols as sponsored by the American Institute of Electrical Engineers. However many prints—especially those of older apparatus—may contain figures differing from the adopted standards. Some of these are included in the chart.

When to Check

Frequency of inspections will depend entirely on the severity of service of the equipment. Ordinarily controls that operate up to four times a day should be inspected at least once a month. If operation is more frequent, inspection may be necessary every week—or even every day.

At the periodic inspections, every part of the control equipment should be checked for proper operation and satisfactory condition. Except when noting the operation of the control apparatus, always open the line switch before attempting to make any inspections, adjustments or repairs. The operation check should determine not only whether the mechanisms function, but also that they work smoothly and uniformly. In the case of automatically operated controllers, see that they speed up the motor at the correct rate. A controller that accelerates too rapidly may cause undesirable line voltage drops or blowing of fuses; one that accelerates too slowly can cause the motor to overheat or the starting resistors to burn open. In adjusting a controller for acceleration, connect an ammeter in the motor circuit and see that the current taken by the motor never excessively exceeds the recommended rating of the line fuses.

Acceleration speed of controllers is regulated in various ways. Some types utilize mechanical escapements; some air or oil dashpots; others make use of timing motors, magnet-operated capacitor relays, or decay of flux type relays. Usually the mechanical escapement, air or oil dashpot and motor operated timing devices can be adjusted or corrected quite simply—either by cleaning, remedying some misadjustment, or by replacing worn or damaged parts. The magnet-operated capacitor and decay of flux type relays require additional attention and reference should be made to the special instruction books furnished by the manufacturer.

If the operating mechanism of a controller is sluggish, open the line switch and try the mechanism by hand. The cause of the trouble can usually be discovered in this manner. However, distortion of the mechanism due to magnetic force may sometimes produce an operating condition different from hand operation.

When control apparatus is found dirty, it should be cleaned before the inspection is continued. Dry dust and dirt may be blown off with dry, medium pressure compressed air. Grease, oil, or sticky dirt may be removed with a wooden scraper or stiff bristled brush followed by a cloth moistened with carbon tetrachloride. Avoid soaking the parts with cleaning fluid—especially the coils. Small metal parts may be effectively cleaned with a clean paint brush dipped into the solution. All parts should be thoroughly dry before the appartus is returned to service.

What to Check

Daily, weekly or monthly inspections should include checks for each of the following:

On magnet-operated devices: excessive heating of parts, shown by charred insulation and discolored metal; corrosion of metal; wear or breakage of shunts; free movement of operating parts; excessive noise; condition of contacts; proper contact pressure; loose connections and part fastenings; worn or broken parts; damaged arc chutes; excessive arcing at the contacts; condition of the apparatus and enclosing case from the standpoint of surroundings (dripping water, ex-

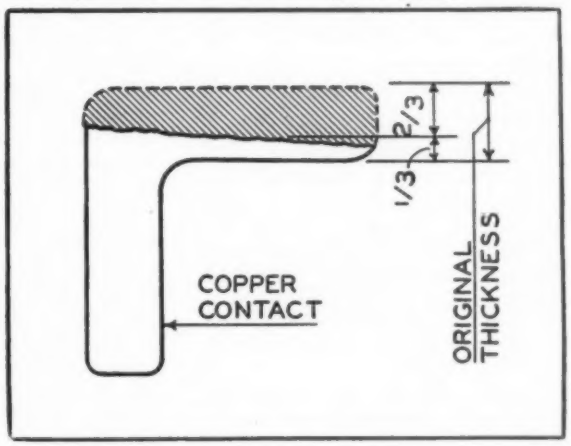


Fig. 2 — Replace contacts when 2/3 of the original thickness is worn away.

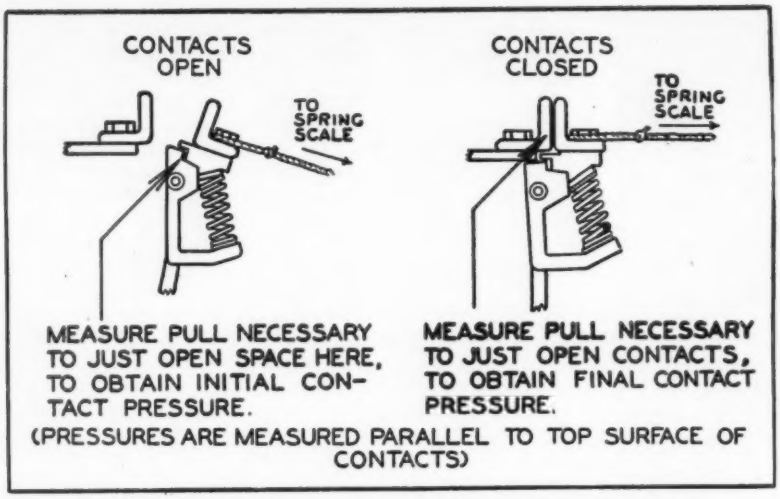

CONTACTS OPEN
TO SPRING SCALE
CONTACTS CLOSED
TO SPRING SCALE
MEASURE PULL NECESSARY TO JUST OPEN SPACE HERE, TO OBTAIN INITIAL CONTACT PRESSURE.
MEASURE PULL NECESSARY TO JUST OPEN CONTACTS, TO OBTAIN FINAL CONTACT PRESSURE.
(PRESSURES ARE MEASURED PARALLEL TO TOP SURFACE OF CONTACTS)

Fig. 3—One method of conducting contact spring pressure test.

cessive humidity, heat, dust or abrasives).

On oil immersed equipment: level of oil, sludge, and sealing gaskets. Gaskets should also be examined on watertight and dust-tight apparatus.

On motor-operated timers: defective sequencing of devices; wear of sliding contacts; and condition of gearing. Lubricate parts when recommended by manufacturer.

On thermally operated devices: condition of the heating element and contacts; opening of contacts upon tripping of mechanism; and the tightness of fastenings.

Semi-Annual Overhaul

In many cases a general inspection and overhauling of control equipment every six months is desirable. Beside the details covered in the periodic checkups this should include inspection of all current carrying connections; checking of resistors, transformers, rectifiers, capacitors (discharge cautiously first to prevent severe shock), wiring, bus and cable work.

In addition examine such auxiliary control devices as push buttons, knife switches, master switches, drum controllers, rheostats, limit switches, float, flow or pressure switches, and speed limiting or governor switches. See that the contacts are in good condition, not burned or excessively rough or worn; that springs, shunts, and mechanical parts are in operating order; and that the insulation is intact and free from charring or excessive wear. Examine fuse ferrules and clips for corrosion, and polish with fine sandpaper where necessary. Proper contact pressure can be restored by bending clips slightly.

Contacts are generally the most vulnerable parts of controllers and switches. Copper contacts sometimes oxidize at normal temperature particularly if they operate infrequently. This condition causes high resistance between contact surfaces and results in excessive heating. Oxidation can be removed by a few strokes with a fine file.

Merely roughened contact surfaces do not require smoothing unless a large projection appears on the metal. A rough contact will carry current satisfactorily as long as it is not oxidized and meets the other contact in proper alignment. Do not lubricate controller contacts as the burning oil will shorten the life of the contacts.

Usually the slight rubbing action produced by the closing the contacts is sufficient to keep copper contacts free of oxide. But if the contacts control a highly inductive circuit, or if they operate in an atmosphere of corrosive gases, oxidation may be too rapid to be removed in this manner. In such cases special type contacts are recommended.

Some controllers employ silver contacts since these oxidize more slowly than the copper. Silver contacts need not be filed to remove oxide, though a small amount of filing may be necessary to remove rough projections. Where sulphur gas is present, a sulphide may form on silver contacts. This should be removed if it interferes with contact conductivity.

As contacts wear, pressure must be maintained by the wiping springs, which press the movable contacts against the stationary ones when closed. If a contact is worn until only a third of its original thickness remains, replacement is in order. (Fig. 2) However, contacts should always be replaced in pairs or sets. Do not operate one new contact and a worn one as a pair. Be sure to tighten contacts seecurely in place and to have them accurately aligned.

Springs

Contact springs may lose their temper through overheating and thus become weaker. Such springs require replacement to maintain proper pressure on each contact and equal pressure on all contacts. Usually the correct spring pressure, and the method of measuring it, is given on the controller instruction sheet. One method of conducting a contact spring pressure test is shown in Fig. 3.

Standard operating coil temperatures should not be permitted to rise above 65 degrees C. Coils of a-c controllers will operate satisfactorily between 85 and 110% of rated voltage, and those of d-c controllers between 80 and 100%. The armature must seal properly with the stationary frame

Maintenance of correct spring pressure is a "must" for efficient controller operation.

on a-c controllers to keep the current in the coil at the minimum. If the armature is blocked open or cannot seal properly because of dirt deposits, or if the voltage is too low for closing, the coil will become overheated by excessive current flow and may be damaged in a short time. On d-c controllers a resistance is usually connected in series with the coil after the contacts close. This reduces the holding current flow through the coil. If the shunt contacts of the coil resistor circuit fail to operate and break the circuit, the coil will quickly overheat.

Operating coils are fragile and should be handled carefully. Never carry them by the wire leads or bend the terminal connections. They should be stored in a dry place, and protected from moisture when in service. Coils that have become wet or soaked in carbon tetrachloride to remove grease or oil should be baked at 110 to 125° C. They may then be protected against moisture with a coat of approved insulating paint or varnish. This coating should be applied while the coils are still warm from baking. When mounting, the coils should be securely fastened to prevent their movement by magnetic stress, as this may cause insulation abrasion.

Check controller surroundings to see that no source of heat or cold is near enough to interfere with the operation of the overload relays, which are calibrated to function at normal room temperature. Such unusual conditions should be compensated for by the use of a recommended rating of relay heater element.

Voltage

At the semi-yearly inspection check the voltage of each controller circuit and the current taken by the motor. Overvoltage can cause excessive wear of controller parts and shorten coil life, while undervoltage can cause

(Continued on page 120)

STANDARD SYMBOLS FOR ELECTRIAL DRAWINGS

Potential terminal Current terminal	Power circuit Control circuit	Normally open contact	Normally closed contact
Conductor underground or in conduit Future conductor	Spliced conductors, or change of type or size	Normally open contact with time closing feature	Normally closed contact with time opening feature
Incoming lines Outgoing lines	Crossing of conductors not connected	Disconnecting device (coupling or plug type contact)	Disconnecting switch (one pole)
Crossing of connected conductors	Joining of conductors not crossing	Double throw switch (one pole)	Knife switch
Ground connection	Conduit or grouping of leads	Air circuit breaker	Power circuit breaker
Motor field (Note:commutating,series, and shunt fields may be shown by 1,2,&3 zigzags respectively)	Repulsion, single or split phase induction 2 or 3 phase 3 wire 2 phase 4 wire squirrel cage motor or generator	Fixed Coil (Note: Series and shunt coils may be shown by heavy and light lines or one and two zigzags)	Operating coil
3 Phase wound rotor or synchronous induction motor or induction generator	3 Phase synchronous motor or generator or condenser	Blowout coil	Resistor Resistor (Former symbol)
2 Phase 3 or 4 wire synchronous motor or generator, or single phase synchronous generator	Single phase shaded pole motor	Adjustable resistor (Fixed taps)	Instrument or relay shunt
Single phase repulsion start induction motor	D-C series motor or 2-wire generator	Rheostat	Transformer
D-C series motor or 2-wire generator with and/or compensating field winding	D-C shunt motor or 2-wire generator	Potential (voltage) transformer	Current transformer
D-C shunt motor or 2-wire generator with commutating and/or compensating field winding	D-C compound motor or 2-wire generator or stabilized shunt motor	Indicating lamp	Instrument or motor (designating letter inside circle)
D-C 3-wire shunt generator	D-C 3-wire compound generator	Fuse	Thermal element
Battery	Fixed capacitor	Normally closed pushbutton Normally open pushbutton	Pushbutton open and closed (spring return)
Mechanical interlock	Direct connected units	Pushbutton open and closed (non-spring return)	Limit switch contacts

These frequently used symbols are considered standard by the American Institute of Electrical Engineers.

MINERAL WOOL DOES GOOD JOB FOR N. Y. STEAM CORPORATION

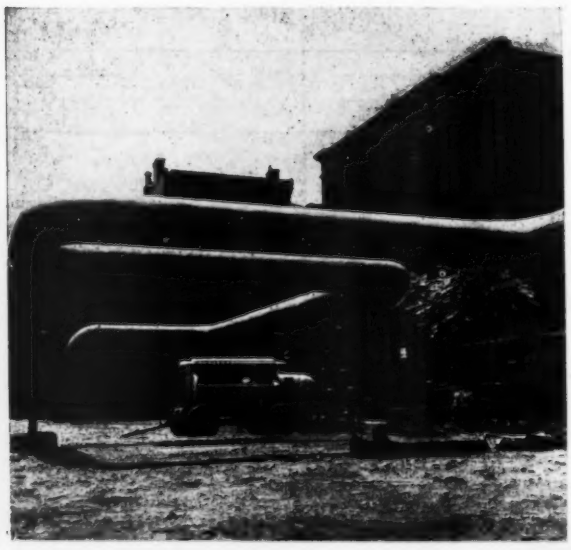
Insulation on new 275,000 lb per hr boiler in the company's W. 66th Street Station controls heat losses so effectively that boiler remains warm for two weeks after shut-down. Similar insulation techniques, plus weatherproof covering, are employed on main steam distribution lines installed out-of-doors.

PARTICULAR emphasis on boiler and distribution line insulation was one of the key considerations in the design of the latest addition to New York Steam Corporation's growing network of steam plants in New York City. The corporation is in the process of extending its central heating facilities from office and municipal buildings to multiple dwellings and recently installed the first of several 275,000 lb per hr boilers which will ultimately heat a sizeable portion of Manhattan's west side.

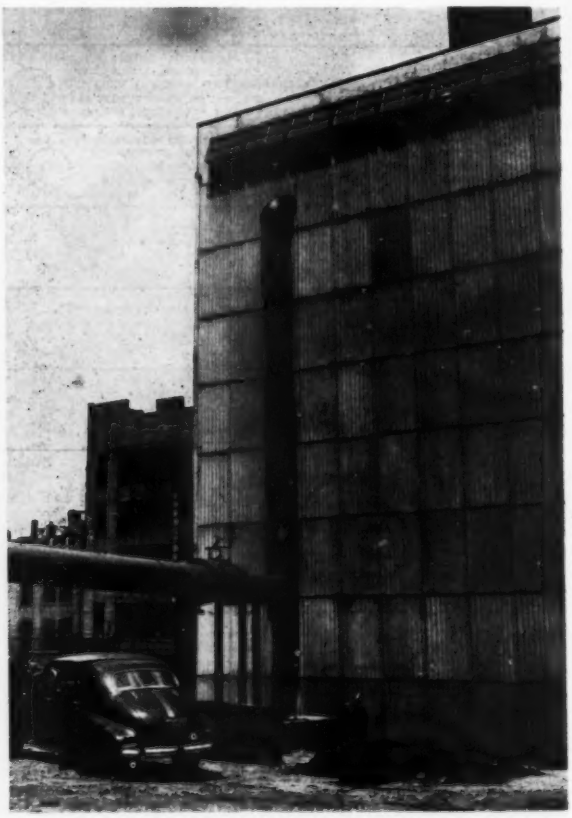
On this installation, adequate insulation was of major importance since the new boiler, slated for winter operation only, was virtually squeezed into a building only slightly larger than the boiler itself. Because of the densely-populated locality in which the plant was built, ample construction space was not available and every square foot of plant property had to be utilized to good advantage. Furthermore, the rear wall of the building is constructed of corrugated steel sheets (for easy removal when a plant extension is made to house additional steam generating units) and does not provide too much protection from cold weather.

Insulation techniques reflect the study and recommendations of an engineer assigned specifically by the boiler manufacturer to determine the covering which would best control heat losses in a boiler designed to operate at 325 psi and to develop a 2000° F furnace temperature. Success of the recommended insulation is indicated by the fact that the new boil-

(Right) Temporary corrugated steel wall will permit future expansion when additional boilers are required. Outgoing 20 in. main is insulated with 3 in. thick mineral wool blankets and covered with insulating cement. Asphalt-saturated roofing felt provides weather protection.



Supports of the 20 in. steam main's expansion loop are equipped with rollers at the top to permit the pipe to expand without bending the supports.



Partial view of the mineral-wool-insulated 275,000 lb per hr boiler. Firebox temperatures reach 2,000°F and steam is generated at 325 psi.

er remains warm a full two weeks after it is shut down.

The firebox is insulated with 2½ in. thick fire brick, 2½ in. of back-up insulation, mineral wool blanketing of the same thickness, and a coating of insulating cement painted with aluminum paint. Insulation is held in place by ⅜ in. studs, welded to the outer surface of the steel firewall, and by washers fastened to the studs on the outside of the metal mesh which covers the mineral wool blanketing.

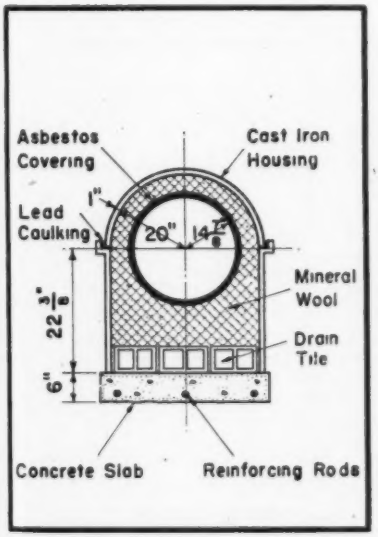
Boiler ductwork also is insulated with mineral wool blankets. Here, however, galvanized wires are welded to the surfaces of the ducts and the blankets are impaled on these wires. The wires are then bent over to hold the insulation in place. Blanket edges are laced together with 16 ga galvanized steel wire, and a surface coating of insulating cement presents a neat and finished appearance.

Steam Main

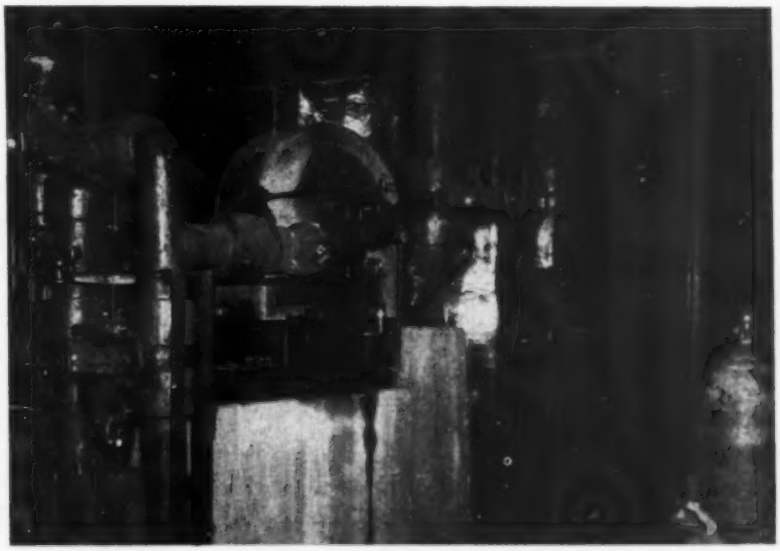
Outgoing 20 in. steam line is insulated with 3 in. thick mineral wool type pipe insulation. The insulation blanket is sandwiched between expanded metal lath on the outside and strips of the same material next to the pipe. The steel mesh not only forms the blanket snugly around the pipe, but also holds the wool fibres in place so that the covering retains its fabricated size and density. Edges of the mesh are laced together with galvanized wire and mineral wool insulating cement is troweled into the mesh to complete the insulation.

As added protection against the weather, sections of pipe installed out-of-doors are covered with a layer of heavy asphalt-saturated roofing felt, all seams being lapped and sealed with waterproof cement. The protecting jacket is held in place with copper wires spaced several inches apart.

Construction of underground mains calls for a variety of techniques governed principally by soil conditions and traffic loads. For example, Fig. 1 shows one type of construction successfully employed by the company since 1925. This particular type of main is installed where the depth below the ground surface is slight, where the line must withstand heavy street traffic, or where protection against ground water is important.



Underground main construction employed when depth is slight, traffic is heavy, or water protection important.



Insulated breeching (background) connects boiler and stack. Turbine (foreground) is rated 235 hp and drives induced draft fan.

V-BELT TESTS AT OSU PROVIDE SURPRISES

Although the investigations described were originally undertaken to determine just what tension should be applied to certain automotive front end drives, the results actually affect all fundamentals of power transmission with modern v-belts.

C. A. NORMAN,
Department of Mechanical Engineering, Ohio State University

IN this country the basic formula for v-belt power transmission was derived on the assumption that, when a v-belt runs over a pulley, both the tight side tension (T_1) and slack side tension (T_2) are reduced by an amount equal to wv^2/g and no force compensates for this reduction.

- w weight of belt in lb per ft of length
- v belt speed, ft per sec
- g gravity acceleration in ft per sec

This assumption has been found wrong in fundamental theory. In practice it amounts to a mere approximation which in itself is wrong as the looser a belt can be run and the less it stretches elastically, the greater the error resulting from the use of the formula.

Centrifugal tension

Actually the centrifugal tension term wv^2/g contains neither the radius of curvature of the belt, nor the contact angle; hence the term is independent of both. A v-belt will hang between two horizontal or moderately inclined drive pulleys in some sort of a curve, which for a perfectly flexible belt would be a catenary. Therefore, in this part of the belt a centrifugal tension wv^2/g adds itself to the tension resulting from the weight. This tension increment between the pulleys would exactly compensate for the centrifugal reduction on the pulleys, and—if the belt did not stretch—the centrifugal force would have no influence on the transmissible power.

However, the centrifugal force tension stretches the belt. This stretching has no effect on the centrifugal tension itself, but it does have an influence on the tension caused by the weight of the belt. The latter tension will decrease with increased sag, i.e. with the stretching of the belt. In other words, when the centrifugal tension stretches the belt (if the belt is at all stretchable) the tension due to weight will be reduced. Formulas to allow for influence of centrifugal force must therefore contain terms reflecting the influence of the tension on sag and belt length.

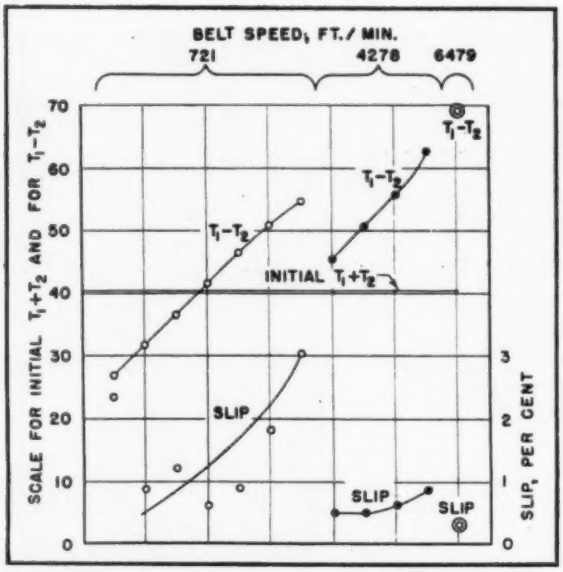


Fig. 1—Computed centrifugal tension and the dead load test verify the stretching action of centrifugal force on a v-belt.

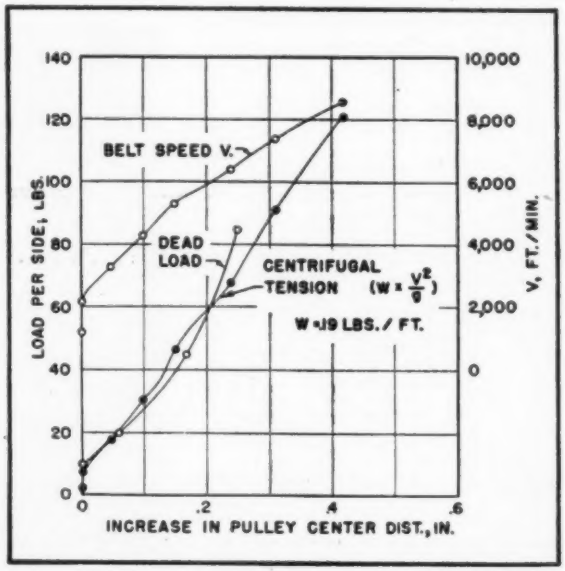


Fig. 2—With a fixed shaft distance an effective pull can be transmitted which is greater than the initial tension.

Please! *Don't Tear*

Other engineers and executives of your company will want to see this issue. Rather than destroy something the other fellow wants to read, write the editors for extra tear sheets for filing or what have you. No charge.

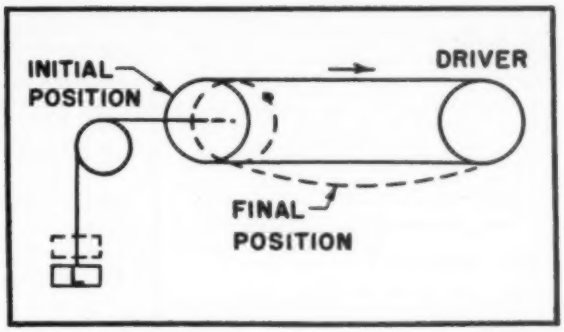


Fig. 3—A floating drive acts as a hoist. The tight side pulls the driven pulley toward the driving pulley.

Centrifugal force, as such, does not bulge the belt, in fact it gives the belt between the pulleys no definite shape whatever. A chain mounted on vertical shafts takes the shape shown in Fig. 4. The bending inward (where the chain leaves the pulley) is due to inertia effects in the links, not to centrifugal force. This bending effect can be eliminated by arranging the pivot points of the links so that the chain tension exerts a righting moment.

A chain hanging slack from a sheave on a horizontal shaft will not bulge, but it can be thrown into all manner of shapes by light knocks or pressure. A perfectly flexible belt would behave similarly. Bulging of a belt is due merely to stiffness, and actual tests show that the bulging force is no greater at 7000 ft per min than it is at stand-still.

That a belt on a fixed shaft distance can transmit more effective pull at high speed than at low is of course no new discovery. The theoretical basis for this situation was at least in part given as far back as 1894.

Fig. 1 plots the results of idling tests run to verify the stretching action of centrifugal force. The driven pulley was mounted on a sliding carriage and both pulleys were 9 in. outside diameter. The belt under test was a smooth cotton v-belt which was fairly stretchable elastically. The pull on the driven shaft was first held barely sufficient to keep the belt running straight. The belt was then idled at 70 rpm and dead loads were applied at the drive end to produce a stretch equal to that produced by the previous centrifugal force. Practically perfect agreement between the computed centrifugal tension (wv^2/g) and the dead load per side for equal stretch was obtained.

Startling Results

New and somewhat startling are the results (shown in Fig. 2) indicating that with fixed shaft distance an effective pull $T_1 - T_2$ can be transmitted which is greater than the initially applied total tension $T_1 + T_2$.

Also Fig. 2 indicates that actually more effective pull can be transmitted at high speed than at low speed. This applies up to speeds of over 6000 ft per min. While the slips increase with the load, they do not increase with the speed for constant load. The actual effective pull $T_1 - T_2$, exceeds the initial tension $T_1 + T_2$ at which load the shaft distance was locked.

Contact Angle

Pulley diameters employed in the tests were such as might be convenient for front-end automotive drives, but they were smaller than those recommended for long life in industrial drives. Even industrial drives, particularly with large transmission ratios, have such small pulleys. Some manufacturers overcome the problem of small pulleys by over-belting the drives—that is, specifying more belts and less load per belt than would be normally required.

In all these cases the question arises about the size of the actual contact angle. This angle is conventionally determined by representing the belt by straight lines drawn tangent to the

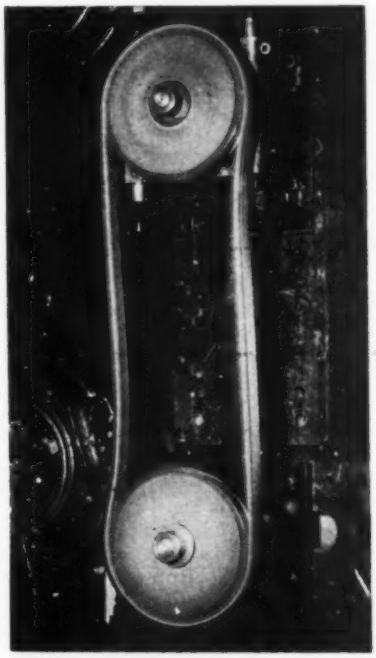


Fig. 4—Left. A perfectly flexible belt reacts similarly to a chain, which tends to bend-in as it leaves a pulley. This is due to inertia effects and not to centrifugal force. A belt bulges merely because of stiffness.

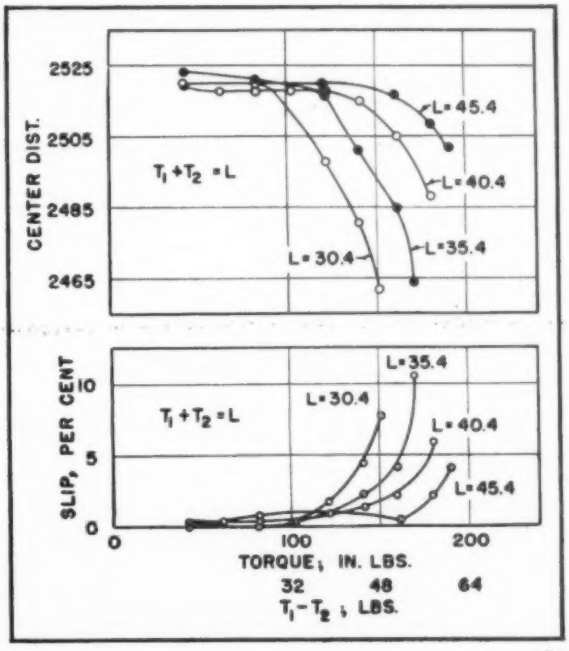


Fig. 5—Right. Effect of increased load on slip and center distance of a floating drive is illustrated by this graph.

pulley circumference. That representation is always wrong, if the belt has any stiffness whatever, since at the running in or running off point of the belt the tension has no moment arm flexing the belt to the radius of curvature of the pulley. With pulleys as small as those tested, the actual contact angle might be much smaller than the one determined by the tangents.

Pulley Diameters

From the point of view simply of the torque transmitted, the tests seem to indicate that for v-belts the ratio of pulley diameter to belt thickness should not be less than 12. For so-called wedge belts (complete v-shaped, not truncated) the ratio of pulley diameter to belt thickness may be 10. These values correspond also, to the minimum diameters usually prescribed to assure reasonable belt life.

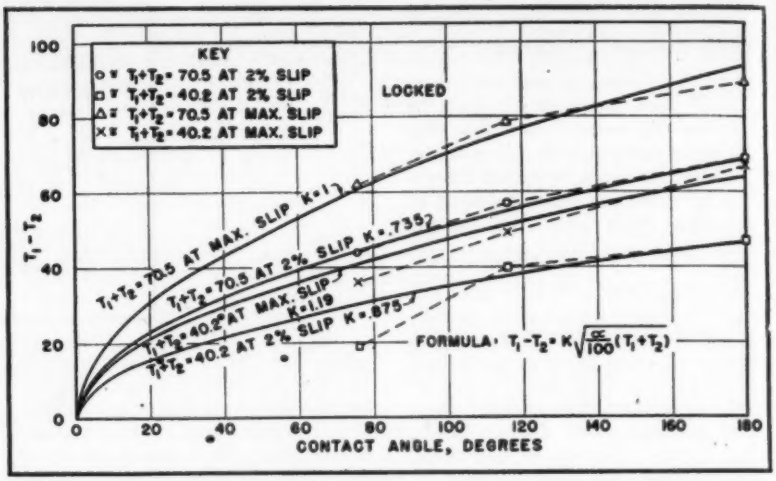


Fig. 6—At least 10% higher effective pull can be transmitted with a fixed shaft distance than with a floating drive (Fig. 7), the initial tension being the same.

Tension Ratio

Ratio of total tension, with power transmission, to initially applied total tension, without power transmission, depends among other things on the stress—strain curve of the belt. The running total tension may be either smaller or larger than, or equal to, the initial tension. If the slack-side tension drops to zero, so that the belt can no longer contact on the slack side, and if power is still transmitted, the total tension becomes simply equal to the tight side tension. In copious tests determinations on contact angle with v-belts more load was transmitted with fixed shaft distance than with floating drive.

For these tests the driven shaft was mounted on a sliding carrier (Fig. 3). When the tension on the slack side approaches zero, providing excessive slip does not occur, the drive becomes a hoist and the tight side pulls the driven pulley toward the driving pulley. The movement increases the slack and decreases the contact angle on the pulleys so that increased slip and finally breakdown of the drive occurs. To keep the shaft distance constant, the load "L" had to be increased. Higher loading increases the contact angle, as well as the tensions, and permits the transmission of a greater effective pull.

Results

Results show that a fixed shaft distance is equivalent to adding to the total tension and permits the transmission of a greater effective pull without excessive slip than does a floating drive. Fig. 5 which shows this effect graphically refers to a horizontal floating drive. The shaft distance and slip are plotted against the torque transmitted or against the effective pull $T_1 - T_2$. The decrease in shaft distance and the beginning of considerable slip, as $T_1 - T_2$ reaches values equal to the tensioning load, are clearly shown. At higher speeds the decrease in shaft distance comes, however, even before the slack side tensions approach zero. The graph should be regarded merely as a qualitative illlustration on what takes place.

Fig. 6 and 7 indicate the increase in effective power that can be transmitted by a locked and an unlocked, or floating drive. These curves indicate that at least 10% higher effective pull can be transmitted with fixed shaft distance than with a floating drive, the initially set T_1 and T_2 value being the same; provided permanent stretch is still inconsiderable.

Application

The formula, shown in both Figs. 6 and 7, is extremely convenient for practical use. *Alpha* is the nominal contact angle in degrees, and values for K can be assumed as 0.55 for small pulleys and 0.66 for large pulleys when drives have fixed shaft distances; for floating drives, K can be taken as 0.5 for small pulleys to 0.6 for large pulleys.

If k_1 is the constant for a floating drive and k_2 the constant for the same drive with fixed shaft distance, the advantage of the latter can best be indicated by the ratio k_2/k_1. This ratio is almost always in excess of 1.1.

The above formula contains no allowance at all for centrifugal force. However, for moderate speeds up to 4000 ft per min. no correction is necessary.

This article is based on a paper delivered before an annual ASME meeting in New York, the Goodyear Tire and Rubber Co. being credited by the author with supporting the investigations liberally. (This article re-run by popular request—Editor).

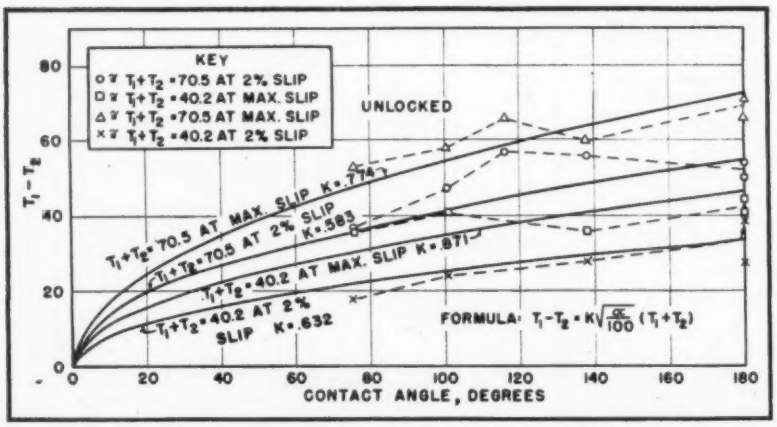
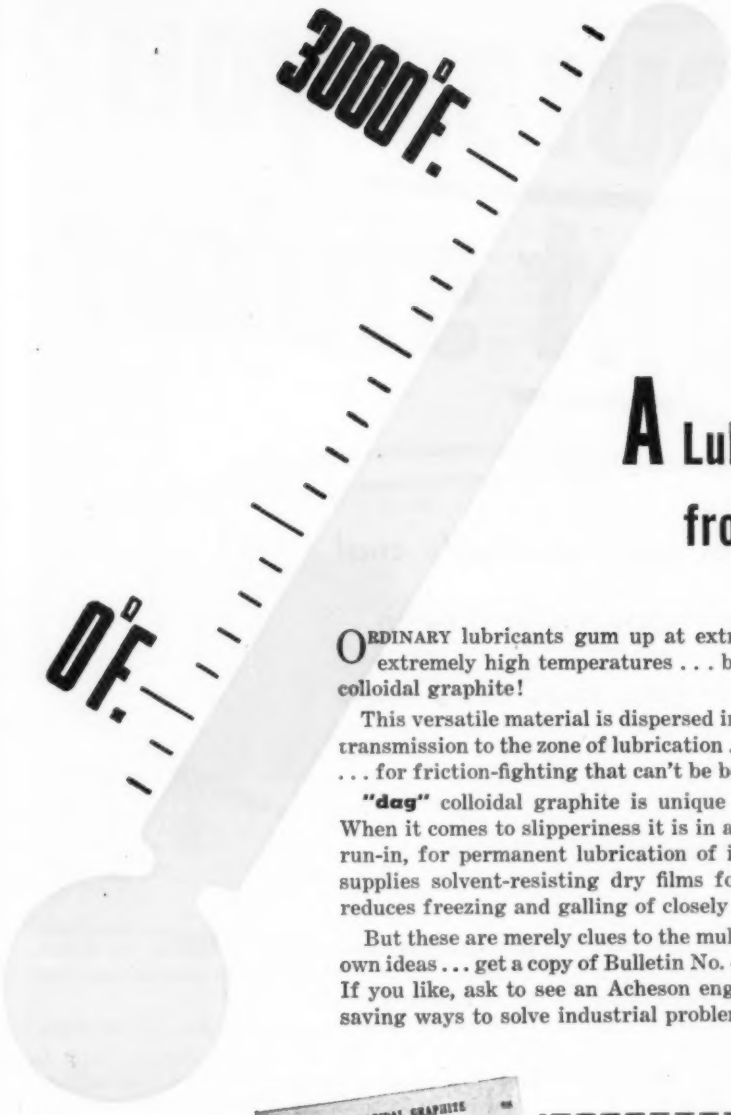


Fig. 7—This graph illustrates quite distinctly the relation between effective pull and contact angle for a floating drive although the values of K applied are somewhat greater than those used in actual practice.



A Lubricant that Works from sub 0 to 3000 plus

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"dag" colloidal graphite is unique in its *combination* of properties and uses. When it comes to slipperiness it is in a class by itself . . . perfect for assembly and run-in, for permanent lubrication of inaccessible parts. It is relatively inert . . . supplies solvent-resisting dry films for degreaser conveyors and alkali washers, reduces freezing and galling of closely mated parts.

But these are merely clues to the multitude of known and unknown uses. Get your own ideas . . . get a copy of Bulletin No. 424 on **"dag"** colloidal graphite for industry. If you like, ask to see an Acheson engineer, experienced in finding new and cost-saving ways to solve industrial problems. Fill out coupon and mail.

Acheson Colloids is equipped to do custom disintegrating, dispersing, and stabilizing of solids in a wide variety of vehicles. If you are in need of this type of service, tell us about it. We may be able to help you.

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Port Huron, Michigan

☐ Send me the NEW Bulletin #424

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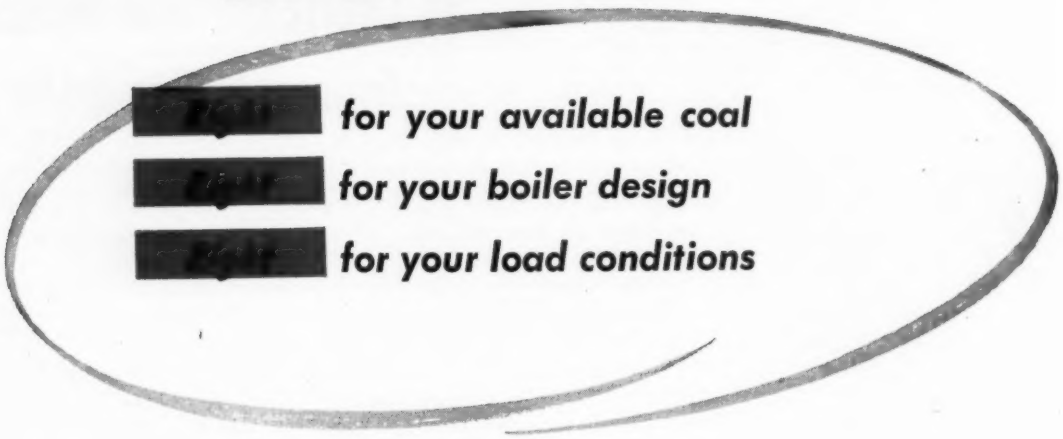
dag DISPERSIONS

Acheson Colloids Corporation, Port Huron, Michigan
also Acheson Colloids Limited, London, England

C-E Assures you the right stoker



When you buy a stoker you want the type best suited to *your specific requirements.* You are sure of getting just that when you turn to Combustion Engineering-Superheater. Why? Because a background of more than 20,000 C-E Stoker installations (above residence size) makes available to you an accumulated experience unmatched by any other stoker manufacturer.

In addition, Combustion offers you the most complete line of stokers available today . . . a line that meets every requirement of fuel and load conditions. Therefore, as the manufacturer of *all* types of stokers, Combustion can give you impartial advice in helping you select the *right* stoker.

And at today's cost of coal, getting the *right* stoker can pay handsome dividends. For in an average installation the cost of coal used in a year exceeds many times the initial cost of the stoker. Thus the first cost of the stoker is soon absorbed by its saving in coal.

Typical of the complete C-E line are the three stokers on the opposite page — Skelly, Type E and Spreader. Each represents an outstanding value in its respective field. Each reflects the practical knowledge of fuels and operating conditions Combustion has gained through 60 years' experience in stoker design and application.

Day in and day out, all over the country, C-E Stokers are getting operating results as good or better than those anticipated at the time of purchase. In short, they are the *right* stokers for the job they were selected to do. So the next time you are in the market for stoker equipment, talk it over with Combustion before you buy. B-372

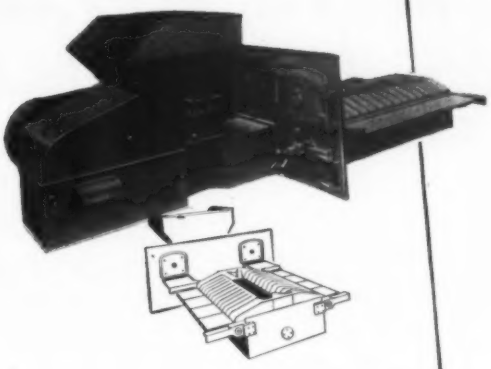
COMBUSTION ENGINEERING

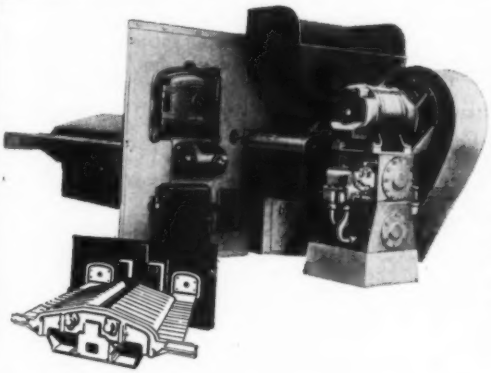
A MERGER OF COMBUSTION ENGINEERING COMPANY, INC. AND THE SUPERHEATER COMPANY

SKELLY STOKER UNIT

Approximate Application Range—20 to 200 boiler hp.

A compact, self-contained underfeed stoker available in designs for burning either anthracite or bituminous coal. An alternate arrangement of fixed and moving grate bars assures lateral distribution of fuel and maintains a clean porous fire. Cantilever dump grates of non-avalanching type simplify ash removal. An integral forced-draft fan, with inlet control, permits positive regulation of air-coal ratio. Sixteen rates of coal feed through variable-speed transmission. Automatic control is standard equipment. Timken bearing equipped. Alemite lubrication throughout.





TYPE E STOKER

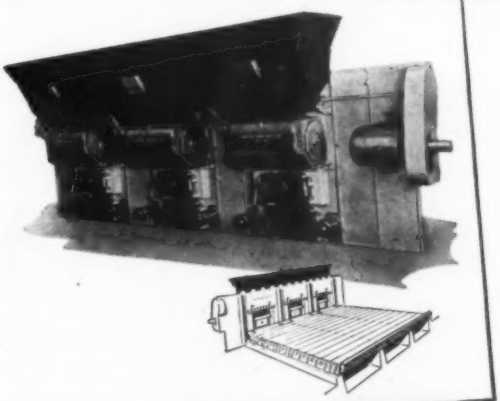
Approximate Application Range—150 to 600 boiler hp.

A single-retort, underfeed stoker designed to burn a wide variety of bituminous coals, particularly those having caking and coking characteristics. The Type E has ram type feed supplemented by a reciprocating sliding bottom. Its grate surface consists of hollow, air-cooled grate bars arranged in an alternately fixed and moving relationship to condition the fuel bed and assure its steady movement to the dump trays which are of the cantilever type. Air supply is under zoned control with provision for introduction of air over the fire. Type E Stokers are available with steam, electric or hydraulic drive.

SPREADER STOKER

Approximate Application Range—150 boiler hp. up to units producing 200,000 lb of steam per hr, or more.

The C-E Spreader Stoker is available in both dumping grate and continuous discharge types. This simple, rugged stoker is designed to burn a wide variety of coals. Hopper, feeding and distributing mechanism, variable-speed drive and motor are combined in a compact unit. Rotating spreader blades feed coal into the furnace in crisscrossing streams which assure uniform distribution. Fines are burned in suspension and the rest of the coal is burned on the grate. Grate surface is zoned for regulating air admission and to facilitate cleaning. All parts subject to wear are readily accessible for inspection, adjustment or replacement, when necessary. Rate of fuel feed and air supply may be regulated over a wide range and are readily adaptable to automatic control.



— SUPERHEATER, INC.

200 MADISON AVENUE, NEW YORK 16, N. Y.

C-E

CONVEYOR BELT CONNECTS NEW AND OLD ROCK DEPOSITS

Six-ply, 36 in. belt carries granite rock and sand 2264 ft from a new deposit to the original plant location. The conveyor passes under a highway and several company railroads while carrying 1000 tons of material per hour.

RECENTLY when a large granite rock and sand deposit at Irwindale, California, dwindled, The Consolidated Rock Products Company installed a conveyor to tap a new pit nearly one half a mile away. The older workings and major processing operations were separated by a public highway and a network of company railroad tracks, according to R. C. Griffin, Consolidated production manager. The company, in making this change over, built a conveyor system employing a 4717 ft belt. The belt—2264 ft from center to center—is believed one of the longest operating on the Pacific Coast and has a lift of 50 ft.

Materials from the conveyor are fed into a surge pile, and later are drawn off to supply the mill. The belt moves at 550 fpm and passes through several tunnels under the highway and railroad tracks. Total carrying capacity is 1000 tons an hour, when driven by a 200 hp motor at 1765 rpm.

Design of the installation was under the direction of Arthur E. Howland, structural engineer of Consolidated. The layout includes the structure carrying the conveyor; the all-steel tower housing the power plant and driving mechanism; gravity takeup pulley and a cantilever design head pulley discharge, that allowed greater strength with the minimum vibration and side strain. Sheet metal decking under the full length of the conveyor protects the return strand of the belt from spillage.

Construction of this 36 in., six-ply cord conveyor type belt consists of parallel runs of cord throughout the belt length. This fabrication method offers greater resistance to impact. Cord diameter and other construction features make the belt capable of transmitting a stress of 70 psi for each ply. The high stress capacity of the cords made it possible to install a belt with minimum of plies. The belt has increased troughability and has permitted utilizing smaller pulleys at both ends of the drive mechanism. In addition initial construction economies were gained by reducing structural weight as well as operating costs.

Acknowledgment is made to the B. F. Goodrich Company for information and illustrations contained in this article.

View through the driving tower shows where the conveyor system emerges from the first tunnel at the Irwindale, California plant.

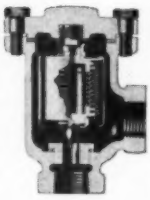
Stacker conveyor discharges into surge pile. Reclaiming tunnel — lower foreground — conveys material to the mill at Irwindale.

How to be Right the first time

WHEN SELECTING STEAM TRAPS

No single type of trap is suitable for all applications. But one of the four distinct Sarco types will be exactly right for any given application. Some provide quicker warm ups in the morning, some extract more of the heat, some are better for fluctuating condensate loads and others are better for out of doors. Sarco has the only plant devoted exclusively to complete lines of steam traps and temperature controls. To be sure, the first time, see Sarco first.

A THERMOSTATIC

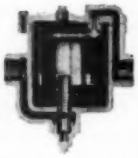


Wide open when cold for quick starts. Retains more of the heat before releasing condensate. Large valve orifice purges air quickly when starting. No seat changes when pressures change. Cannot freeze. Two types—for low pressure heating and high pressure industrial service up to 300 psi. Bulletin No. 250.

B FLOAT

Ball float allows continuous discharge without shock to temperature controls and other instruments. Automatic thermostatic by-pass takes care of air and gases without steam waste. All pressures up to 200 psi. Bulletin No. 450.

C BUCKET



Intermittent, but very rapid—can handle large volumes of condensate. Air goes out with the condensate. All parts attached to cover provide easy inspection. Straight-through connection makes installation easy. Integral strainer inside. Standard sizes to 250 psi. Forged steel types to 900 psi, and superheat. Bulletin No. 350.

D LIQUID EXPANSION

A low cost combination of trapping and approximate temperature control. Ideal for outdoor tanks and lines and other points where condensate cannot be returned. In other forms, used as combination trap and control for wash tanks, food equipment, etc. Catalog Nos. 250 and 550.

APPLICATION	1st CHOICE	2nd CHOICE
Process Tanks, small	A	C
Process Tanks, large	B	C
Dryers, Coil Type	B	A
Dryers, Fan Type	B	C
Drying Tumblers	B	A
Water Heaters	B	C
Preheaters, Fuel Oil	B	C
Rotating Cylinders	B	B
Slashers	B	B
Dry Cans	B	B
Flat Work Ironers	C	B
Presses, Laundry	C	A
Stocking Forms	C	A
Presses, Plastics	C	A
Presses, Platen	C	A
Evaporators	B	C
Steam Lines Outdoors, small	A	D

Ask for Bulletin No. 1600 "Selecting Steam Traps"

267

SARCO SAVES STEAM

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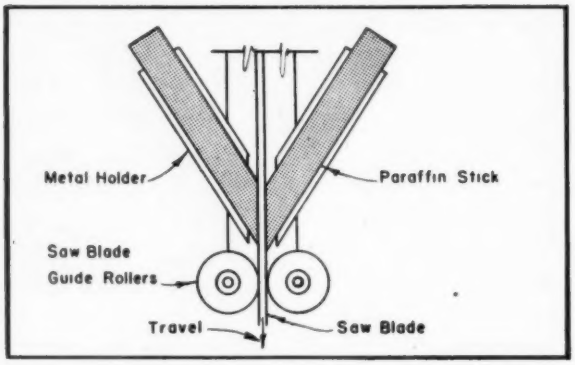
IMPROVES PRODUCT QUALITY AND OUTPUT

How-to . . Shop Kinks and Hints . .

What's your idea? Send it and a rough sketch to the How-to Editor.
We pay at least $10.00 for each item published.

HOW TO:
lubricate combination band saw blades

Combination band saws fulfill a multitude of needs about the maintenance shop for cutting vast variety of metals, plastics, and wood. However, a mechanical lubricating device that requires no "third hand" to regulate or apply is necessary. This need can be supplied for most metal work by fashioning two aluminum holders for attachment to the saw guides and inserting prepared cakes of ordinary paraffin. The loosely fitting paraffin slides downward and



maintains intimate contact with both sides of the blade. The action is slow and uniform, since a combination of friction and heat generated by the saw errodes the required amount of parrafin to lubricate the guide rollers and the cutting operation. The minute film of paraffin does not discolor the most brightly polished metal nor develop an objectionable oily scum about the saw's bench top. The heat of the cut eliminates practically all of the paraffin, thus none escapes to cause slippage on the drive band wheels.

Myron C. Ziemke
Oak Ridge, Tennessee

HOW TO:
obtain the greatest length of service from wire rope

On wire rope applications a definite relationship exists between rope length of life and size of sheave or drum. This relationship is called "sheave rope ratio" or "drum rope ratio" and consists of dividing the diameter of the

EQUIPMENT	SHEAVE & DRUM SIZE
Logging Equipment	10 to 20 times rope diameter
Portable Excavation Equipment	16 to 36 times rope diameter
Oil Field Equipment	12 to 45 times rope diameter
Overhead Electric Traveling Cranes	30 to 40 times rope diameter
Passenger and Freight Elevators	40 to 60 times rope diameter
Mine Hoists and Incline Slopes	48 to 80 times rope diameter
Mine Hoist and Vertical Shaft	64 to 110 times rope diameter

sheave or drum by the diameter of the rope. For example, a rope of 1 in. and a sheave having a 16 in. diameter would correspond to a "sheave rope ratio" of 16. Practice has shown that as the ratio increases the apparent life of the rope increases when all other factors remain constant. However, a practical break off point can be reached, as the sheaves could become greatly oversized, and initial costs would not warrant the installation. Sheaves and drum sizes for various wire rope applications illustrated in the table will prove useful in designing and solving wire rope problems.

Acknowledgment is made to the Macwhyte Co. for this information.

IS 5 MINUTES OF YOUR TIME WORTH 10 DOLLARS?

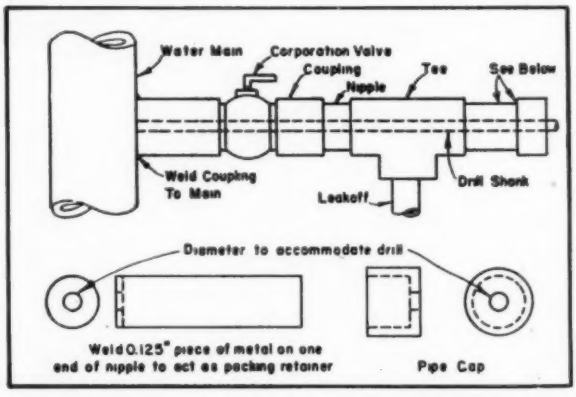
Yes, we know you are busy, but still you have a lot of good ideas that could help the other fellow and at the same time earn some extra dough for yourself.

What about that welding trick you tried last week, or that emergency repair on the pump shaft? Maybe the job you did on the steam line while operations were being held up or the way you found that electrical trouble is just what other plant engineers and maintenance men would like to know.

Why don't you jot down your ideas, and include a rough sketch? You don't have to be an editor or artist —we'll take care of that. Send your material to "HOW TO" Industry and Power and if we can use your idea we will send you a check for at least 10 bucks.

HOW TO:
install a test line when the water main is in service

Sometimes installing a test line in a water main becomes necessary at a time when the main cannot be shut off. When such a situation occurs following procedures shown in the accompanying drawing will make the installation possible without outage. Step number one calls for welding a nipple to the pipe as shown in the diagram. If the water is exceptionally cold two welding torches might be needed to heat the main and make a good weld. The second step is to assemble the various nipples, corporation cock, couplings, and special nipple cap arrangement for guiding the drill.

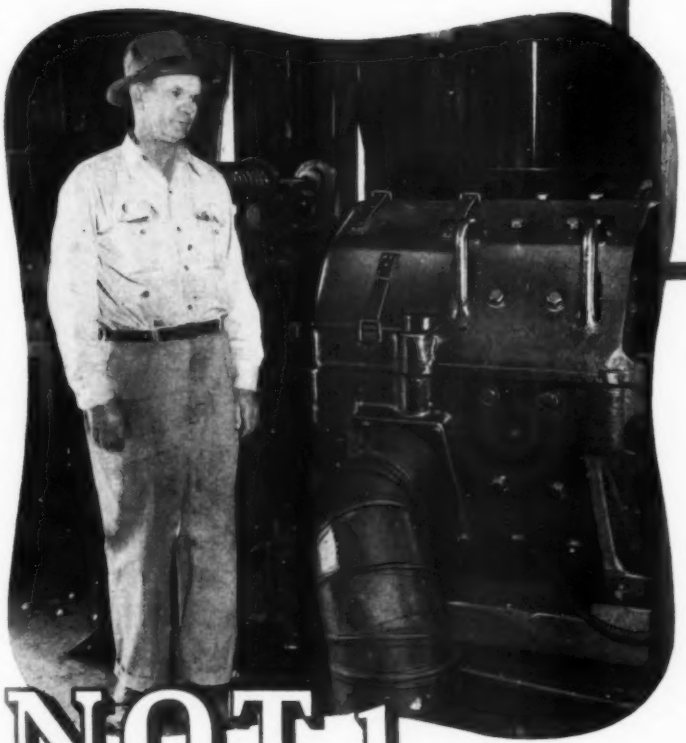


With the cock in the wide open position, the bit is inserted and a hole drilled in the water main. The cock is closed as the bit clears. The assembly from the cock back is then removed and final fittings can be installed.

E. L. Fauth, Quarryville, Pa.

are **coil failures** *costing you money?*

look at this record!



NOT 1 *coil failure*

in 2 years with National special class H coils

"Still operating beautifully," is the report *two years after installation* on the National silicone-glass-mica armature coils of the motor shown above. They were installed January 7, 1948, in the National shop. That's quite a record, following the 18 failures in 8 years listed at the right above.

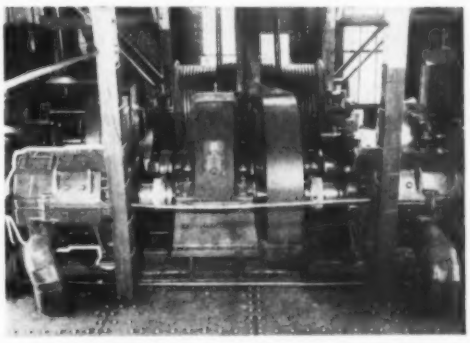
The motor is, of necessity, subjected to terrific abuse, since it is a hoist motor on a huge coal stripping shovel which often bites into solid rock. Excess heat burned out the coils monotonously . . . until National installed the special coils.

Special National Class H coils such as these are building up amazing records wherever high heat is a problem. They utilize silicone, melamine, glass, mica, MICA-GLAS, high-heat varnishes, special solders and other inorganic materials. The insulating materials are made in our plant to our rigid specifications. And all National coils fit snug and tight. They last.

Many armature burn-outs can be avoided by the use of higher grades of insulation. However, all-inorganic insulation isn't always the entire answer. Improved ventilation, better heat conductivity and other factors are also of importance. Your nearby National Field Engineer knows. Write for his name.

18 *failures in 8 years with regular insulation*

Date	Cause of Failure
2/21/40	Armature coils grounded
12/29/40	Armature coils grounded
9/2/41	Open armature circuit
4/13/42	Armature coils grounded
4/18/42	Leads loose in commutator
10/24/42	Armature band thrown
4/5/43	Armature coils grounded
8/9/43	Open armature circuit
10/7/43	Armature coils grounded
9/30/44	Armature coils grounded
10/18/44	Armature coils grounded
7/28/45	Armature coils grounded
9/14/46	Armature coils grounded
2/6/47	Armature coils grounded
6/23/47	Armature coils grounded
9/17/47	Armature coils grounded
11/4/47	Armature band thrown
12/26/47	Armature coils grounded



Part of the interior of the strip shovel is shown above. The motor outlined is the one which caused so much trouble and expense before National special Class H coils were installed. A larger view of the same motor is shown in the photo at the upper left.

NATIONAL ELECTRIC COIL COMPANY

COLUMBUS 16, OHIO, U. S. A.

Spot News

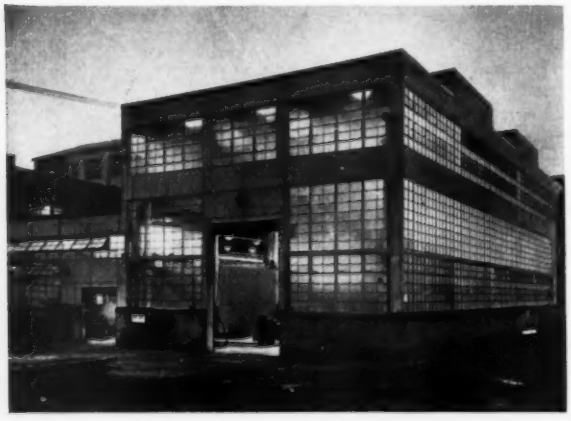
Short, "boiled-down" paragraphs on the most interesting recent events and developments in American industrial plants.

Centralized Production Addition Simplifies and Increases Builders Operations

Production problems encountered in expanding existing structures in plants where the activities vary from month to month, were overcome when the Cooper-Bessemer Corporation, Mt. Vernon, Ohio completed their new expansion. The company—manufacturers of large gas and Diesel engines for locomotives, marine, and power generation—answered the problem by erecting a centrally located addition adjacent to existing production facilities. Unexpected overloads can now be absorbed and a steady flow of equipment will be maintained eliminating costly production bottlenecks.

"Because in a heavy industry like ours", explains Mr. Peter Letz, works manager of Cooper-Bessemer, "department overload at one time or other are common while others are relatively idle, and the reverse condition can be found a few weeks later. Our approach to the problem has been to design the new plant addition, not only for the efficient assembly of machinery sub-units like compressors and power cylinders, but to be converted quickly with little expense for the assembly of complete engines. The space can be utilized also for actual machining operations, for welding, or even for foundry molding operations".

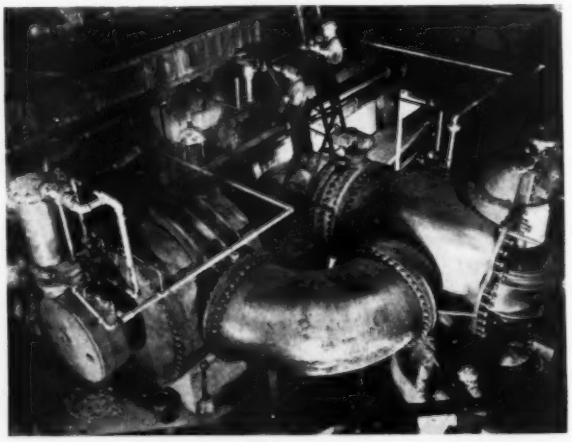
Erection costs totaled $210,000 for the addition, which consists basically of two bays that make available 11,000 sq ft of useful floor space. One bay 30 ft high has a 30-ton crane with the same track span as existing equipment in other parts of the plant. This feature provides added flexibility to plant operations since the crane can be moved to other plant locations at any time production activities so demand. The second bay, having a ceiling height of 20 ft and provided with similar crane facilities, is ideal for lighter and simpler plant operations.



Building framework is light weight throughout. The side covering is transite with glass window paneling attached directly to the wall studding. Continuous convection wall type of heating is supplemented by blower units near the ceiling to assure more even heat distribution.

"Flood-Proof" Water Works Pump Will Deliver 100,000,000 Gal Daily

Pumping raw water at the city of Pittsburgh municipal filtration plant will be continuous, regardless of river conditions, when the first "flood-proof" pump is placed in



operation. The new pump, a single stage centrifugal unit with 12 ft 1½ in. dia. and operated at 327 rpm, was manufactured by DeLaval Steam Turbine Company, Trenton, N. J. It will be installed by Dravo Corporation, Pittsburgh representatives for DeLaval. The 1250 synchronous motor driver will rest on a reinforced concrete platform above the highest flood stage reached by the river at the station. The pump has a suction diameter of 54 in. and a discharge of 58 in. Capacity when overcoming a head of 58 ft will be 100 million gal per day.

"Mock-up" Reduces Production Line Costs

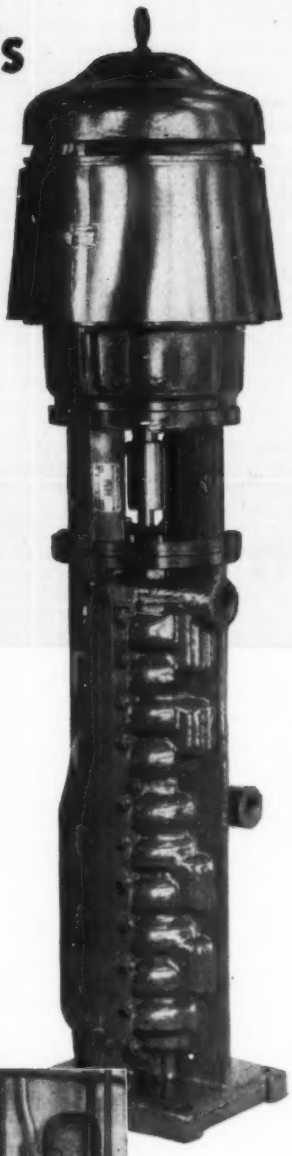
At a recent press conference Harold F. Kneen, vice president in charge of manufacturing at The Lincoln Electric Company, announced that approximately $80,000 had been spent to complete a mock-up of production lines to be installed in their new plant. Mr. Kneen reviewed the steps that were taken to develop and pre-test manufactur-

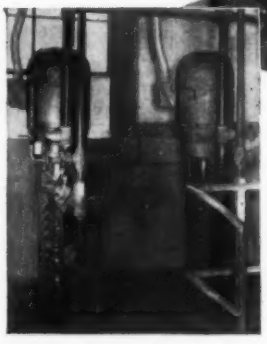
(Continued on page 112)

this small, low-priced

BJ HYDROPLEX PUMP

is *engineered* for economical boiler feed service





THESE HYDROPLEX PUMPS provide 30 gpm of cold condensate at 435 psi. They are 10-stage units, driven by 25 hp motors at 3550 rpm.

- For medium pressure, medium temperature, low capacity pumping.
- Uniform, non-pulsating flow.
- Variable capacities without by-pass or speed change.
- Vertical construction—needs only a simple foundation and a minimum of floor space.
- No relief valves.
- Only one stuffingbox . . . and it is under suction pressure.
- Radial forces balanced at all loads by staggered volute construction.
- Axial thrust balanced by opposed grouping of impellers.
- Easily dismantled and reassembled.

IF YOUR PUMPING JOB involves a medium pressure, medium temperature, low capacity operation, the BJ Hydroplex can do it with quiet, smooth efficiency *and with less installation and maintenance cost*. This smaller, low-priced version of the highly successful BJ Hydropress centrifugal pump has a capacity range from 10 to 140 gpm at heads of 450 to 1700 feet. It operates at high speeds—3550 rpm on 60 cycle and 2950 on 50 cycle and higher in special units.

You'll find that this simple, dependable BJ Hydroplex has definite advantages over complex displacement type pumps. For full information, send the coupon now.

BJ PUMP DIVISION, DEPT. 61

Our problem is pumping_____ gpm of_____
at a head of_____ Tell me more about the BJ Hydroplex.

NAME_____

COMPANY_____

ADDRESS_____

CITY_____ STATE_____

No obligation, of course.

Byron Jackson Co.

Since 1872

P. O. Box 2017 Terminal Annex, Los Angeles 54, Calif.

OFFICES IN PRINCIPAL CITIES

"K" CAST-IRON FITTINGS
GIVE YOU
THE CRAFTSMANSHIP
OF SPECIALISTS

"K" on a cast-iron fitting is the trademark of a company that has specialized on this class of product for more than sixty years. All of our efforts, skills, and facilities are devoted exclusively to the manufacture of cast-iron fittings which we guarantee to be sound and accurate in every respect.

A large proportion of the country's leading plant engineers and piping contractors have learned that it pays to use "K" Cast-Iron Fittings. This is evidenced by the growth of our business, which has required numerous plant expansions to keep a complete supply of "K" Fittings in stock for immediate shipment.

The "K" line consists of 3,000 sizes in the following types:

Standard and Extra Heavy Flanged Fittings
Standard and Extra Heavy Screwed Fittings
Drainage and Sprinkler Fittings
Standard and Extra Heavy Companion Flanges

We have a handy pocket gage for measuring pipe sizes. It contains a table of theoretical allowances for make-up when pipe is forcibly screwed into fittings. If you want one, mail a request on your letterhead.

PRECISION FITTINGS

THE
KUHNS BROTHERS CO.
1806 McCALL AVENUE
DAYTON 1, OHIO

Combined Market Facilities with Malleable Iron Fittings Co., Branford, Conn.

(Continued from page 110)

ing procedures. He further stated that direct costs were reduced 10% in 1948, another 10% in 1949 by the rearrangement of materials storage and production sequence that resulted from this study.

Closer integration of manufacturing sequence has led in some places to the complete elimination of operations which interrupted flow. In some instances redesign was necessary. Single machines capable of producing products for two separate production lines were duplicated in order to handle operations on both products "in lines".

Formerly 34 persons were required to keep the necessary inventory and control records and to handle transfer of materials from storage to production. Now, these workers have been transferred to productive work. Also the number of inspectors has been cut in half as the result of new procedures, and paper work has been elminated by the adoption of visual inventory controls. Storage sites are

at the point of application, in marked spaces, so the operator can see if the supply is running short. Men on each individual line alert the stock area men as soon as the supply falls below a given point.

Production lines in the new plant will parallel the aisle columns. Stock and auxiliary processing operations serving the production lines will flow from the aisles to mechanized assembly lines along the columns.

In describing the project, Mr. Lincoln said, "The new plant will be a stock room with manufacturing space adjacent to the stock. No material will be moved more than twice—once as a raw material, and the next time as a subassembly or a finished product. Overhead handling in the new plant will save 20% on floor space required for the operation. Delays in manufacturing will be eliminated and productivity increased as a result of benefits to be obtained in the new plant".

Production will be contained in a one-story structure—1400 ft long by 500 ft wide, coordinated and built by The Austin Co. A centrally located 60 ft wide service floor extends the full length of the building below ground level. A common entrance leads down a double stairway to the service level, plant entrance, two-story office lobby, large cafeteria and kitchen, conference and demonstration rooms, and the Lincoln welding school. Employe facilities will be located along a 20 ft corridor on the service floor, with locker rooms and sanitary facilities at convenient intervals. Provision has been made to install 20 stairways leading from the corridor to the middle of the production floor at different points along its quarter-mile length. Transformers and other building service equipment will be located along the service corridor and will facilitate distribution of power, air, water, and other service lines throughout the plant.

(Continued on page 114)

MILLION TON TORTURE TEST

...READY FOR MORE!

QUAKER CONVEYOR BELTING

PERFORMANCE-PROVED TO GIVE LONGER SERVICE

Day in day out . . . year after year . . . for eleven years more than a million tons of rock smashed down and was carried along by a Quaker Ironsides Conveyor Belt. This 24" wide belt takes an impact drop of four feet and runs on a grade that starts at four feet off the ground to a height of fifty-five feet . . . carries 60 to 100 yards of material per hour. After a million tons, it is still good and ready for many more.

Whatever your belting needs in your plant . . . flat transmission belts, V-belts or conveyor belts, you can rely on Quaker for long, performance-proved service. Every belt built by Quaker is thoroughly pre-tested in the plant . . . every type has been performance-proved on the job. To economize on belting, you'll find it pays to Quakerize your plant.

QUAKER PACKINGS FOR SAFER SEALS

Scientifically pre-tested . . . ruggedly performance-proved Quaker Packings are engineered for every use in your plant—for pumps, compressors, water, air and steam lines and many other places where a positive, long-lasting seal is needed.

QUAKER HOSE FOR RUGGED WEAR

Pre-tested for flexibility and strength . . . built to stand abrasion . . . performance-proved for rugged resistance to wear . . . every Quaker Hose has been scientifically developed for a specific application . . . to provide longer service in your plant. There's a Quaker Hose to meet every industrial requirement.

QUAKER RUBBER CORPORATION · PHILADELPHIA 24, PA.

Division of H. K. Porter Company, Inc.

New York 7 · Cleveland 15 · Chicago 16 · Houston 1

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QUAKER PACIFIC RUBBER CO. · San Francisco 10 · Los Angeles 21 · Seattle 4

QUAKER RUBBER PRODUCTS

custom made for every industrial use

KEY-TITE Water, gas, low-pressure steam and compressed air lines are completely sealed when you use KEY-TITE. This lead-free compound does not affect taste or odor of potable liquids.

KEY GRAPHITE PASTE

Oil, gasoline, kerosene and high-pressure steam lines require the perfect seal provided by KEY GRAPHITE PASTE. With KEY, pipe joints are sealed and lubricated at the same time.

Pipe joints and fittings sealed with Key Pipe Joint sealing compounds do not leak. Connections will not freeze and reopening is easy.

There is a Key compound to fit your pipe joint sealing requirements. Send for free sample.

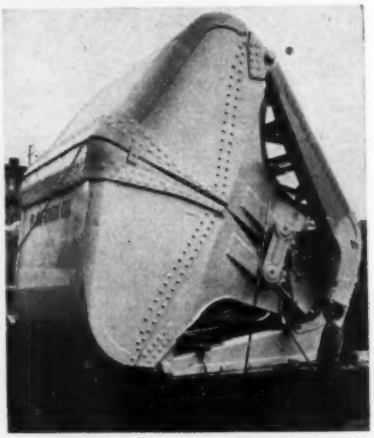
KEY Company

KEY COMPANY
321 South 27th St.
East St. Louis, Ill.

(Continued from page 112)

Clamshell Bucket Has 17 Ton Lifting Capacity

Because of its size, this large clamshell bucket was loaded on its side in a specially depressed freight car and dispatched over several railroad lines to avoid tunnels and low clearances points by the more direct route to its destination.



Known as a four-rope type bridge bucket, it will be utilized to transfer coal from water crafts to storage piles or hoppers. This clamshell, manufactured by Blaw-Knox Company, has a capacity of 17 tons, and three lifts would fill a conventional railroad coal car. The bucket tare weight is 32,000 lb. Over-all dimensions are: width 9 ft 11 in., open length 21 ft, closed length 15 ft 7 in., open height 18 ft 5 in., closed height 15 ft 11 in.

Bulldozer Handling of Coal Reduces Manpower

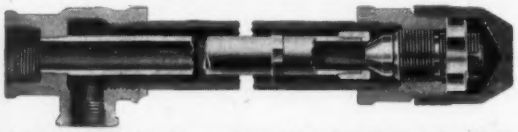
Announcement has been made by the R. G. LeTourneau,

(Continued on page 116)

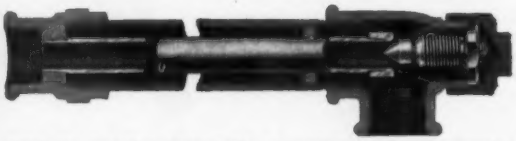
NOT 1 CENT for Repair Parts

for 444 Nicholson Steam Traps Installed in 2 Years

Here is added evidence of the remarkably low maintenance costs of Nicholson expansion steam traps. In the 2 years Bradshaw & Co. have been distributing them in the Pittsburgh area they have installed 444 traps. But they have received not one order for repair parts. And examinations of traps in continuous drainage service for at least 18 months, at steam pressures to 250 lbs., showed no sign of valve cutting.



TYPE RF Expansion Steam Trap — Installed horizontally. Both types are for steam or hot water; pressures up to 250 lbs.



TYPE SF—Installed horizontally or vertically without supports.

Easily Installed, Low Cost

Because valve is easily adjustable to pass condensate at any temperature below 212°F., these traps are also widely used for regulating temperature of equipment.

For All Equipment Using Steam or Hot Water

Radiators	Kettles	Switch Heaters
Separators	Railway Coaches	Laundries
Paper Machinery	Dry Kilns	Plastic Molding Presses
Pipe Coils	Vulcanizers	

W. H. NICHOLSON & CO.
135 OREGON ST., WILKES-BARRE, PA.

Catalog 448 or see Sweet's

Representatives, in 53 Principal Cities, to Help You Solve Specification and Maintenance Problems in Traps, Floats, Control Valves

"These brick have been in service since you were born!"

NEARLY A GENERATION AGO, a large copper mining company relined the rear walls of two B&W boilers with B&W 80 Firebrick. For 17 years of constant operation at high ratings these brick provided top, trouble-free, maintenance-saving service.

Today, B&W 80's are one of a wide range of superior B&W Refractories — all designed to give the type of service that means profitable operation. Here, for example, are five B&W castables that will help you speed furnace construction:

KROMECAST

for temperatures up to 3100F

KAOCAST

for temperatures up to 3000F

B&W HYDROCHROME

for temperatures up to 2800F

B&W BAFFLE MIXES

for temperatures up to 2600F

B&W INSULATING CONCRETE-MIXES

for temperatures up to 2200F
PLUS INSULATING EFFECT

Whether your needs are for heavy firebrick, light-weight insulating firebrick, or refractory castables, plastics and mortars, you can find the type most economical for your needs in B&W's complete line of refractories. Call your local B&W Refractories Engineer today.

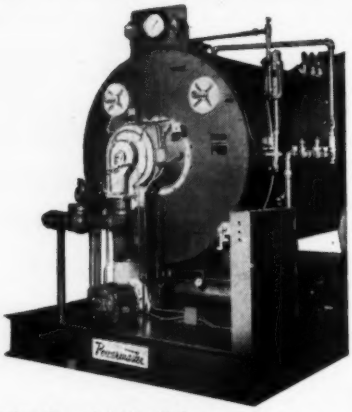
BABCOCK & WILCOX

THE BABCOCK & WILCOX CO.
REFRACTORIES DIVISION
GENERAL OFFICES: 85 LIBERTY ST., NEW YORK 6, N.Y.
WORKS: AUGUSTA, GA.

B-350

B&W REFRACTORIES PRODUCTS — B&W 80 Firebrick • B&W Junior Firebrick • B&W 80 Glass Tank Blocks • B&W Insulating Firebrick B&W Refractory Castables, Plastics and Mortars • **OTHER B&W PRODUCTS** — Stationary & Marine Boilers and Component Equipment . . . Chemical Recovery Units . . . Seamless & Welded Tubes . . . Pulverizers . . . Fuel Burning Equipment . . . Pressure Vessels . . . Alloy Castings

CUT your
STEAM
COSTS
as much as 40%
with the
O&S Powermaster Steam Generator



Plant operators in many industries are cutting costs up to 40% through advantages like these:

- Low fuel consumption through high efficiency
- Packaged design saves excessive installation costs
- Automatic operation frees engineer for other duties
- Mounted on steel base—no bricking required
- Delivered fully wired and tested—U. L. approved
- Widespread service by factory-trained men

High and low-pressure units—15 to 300 HP.—for light oil, heavy oil, gas or combination gas-oil firing. Free catalog mailed promptly—use coupon below.

ORR & SEMBOWER
Established 1885
Powermaster®
STEAM GENERATORS

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951 Morgantown Rd., Reading, Pa.

Please mail latest catalog showing Powermaster's cost-cutting advantages.

Name_____

Company_____

Address_____

City_____ Zone_____ State_____

(Continued from page 114)

Inc., that the operation of a recently purchased bulldozer has freed a "three man tunnel crew" for production jobs in the Huron-Portland Cement Company's Alpena, Michigan plant. Coal at this plant — which produces over 6,000,000 barrels of cement annually—was originally handled by the tunnel method. Two distribution belt conveyors and an electric crane track were eliminated when the new dozer was introduced.

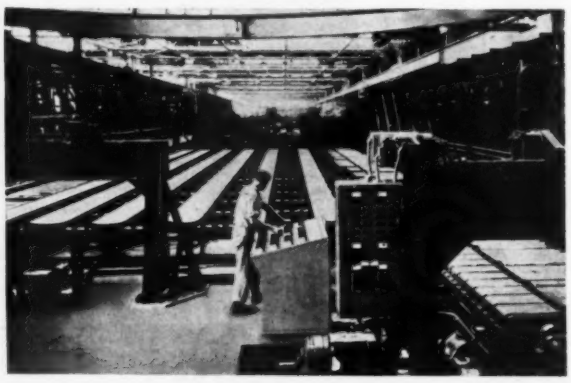
Coal is moved now from 50 to 300 ft at the rate of 1000

tons per day during all kinds of weather. The unit operates 16 hours a day, 7 days a week to handle coal between the stockpile and storage bins. In addition to moving coal, this mobile hauler handles extra assignments around the mill such as: clearing snow, excavating, switches box cars, and necessary handling at the company's dock. Rubber tires enable operation on or over any type of surface without damage.

Cold Rolled Brass Mill Geared to Continuous Brass Casting

With the development of a flat-metal continuous brass casting process, the Scovill Manufacturing Company went all-out to design a suitable rolling mill to realize the full benefits of increased cast brass production. Equipment necessary to construct such a system exceeded $10,000,000, but a revolutionary approach to rolling brass, application practices, and production layouts has resulted. This plant can now produce cold-rolled brass, from continuous casting of large bars to the finished milled products in a straight-flow production.

Metal is melted in one of three 10,000 lb per hour electric induction furnaces, equipped for precision control of



melting temperatures and other factors which influence the metallurgical qualities of the brass. Staggered at 30-minute intervals, each furnace discharges into a 9000 lb capacity holding furnace mounted over the casting machine

(Continued from page 116)

to provide a continuous flow of molten brass. Intermixing furnace charges give additional uniformity of composition. The metal descends through a water-cooled mold.

The casting machine has a capacity of several million lb per week, and it is the only one in America designed to produce flat bars for cold-rolling into brass strip and sheet. The brass is automatically sawed into bars of uniform length that weigh in excess of 2,000 lb. Conventional shearing or sawing gates have been eliminated, and internally sound metal is assured throughout the entire length, width, and thickness of each bar.

Pushbuttons control all the heavy equipment, and wherever possible the operations are automatic. For example on the cold rolling mills, spacing between the working rolls is kept uniform by photoelectric controls which compensate for temperatures variations and roll expansion. Vacuum cup and roller conveyor handling equipment supplants manual handling and are big factors in the virtual elimination of dents, pits, gouges, and scratches in the metal.

Annealing and cleaning equipment incorporates the most modern devices for producing closely controlled annealed tempers and clean, smooth surfaces. The final annealing furnace and cleaning unit are placed so that strips or sheets emerging from the furnace are automatically in position to travel at a controlled speed through the cleansing unit.

Microfilm Service for Industry and Power

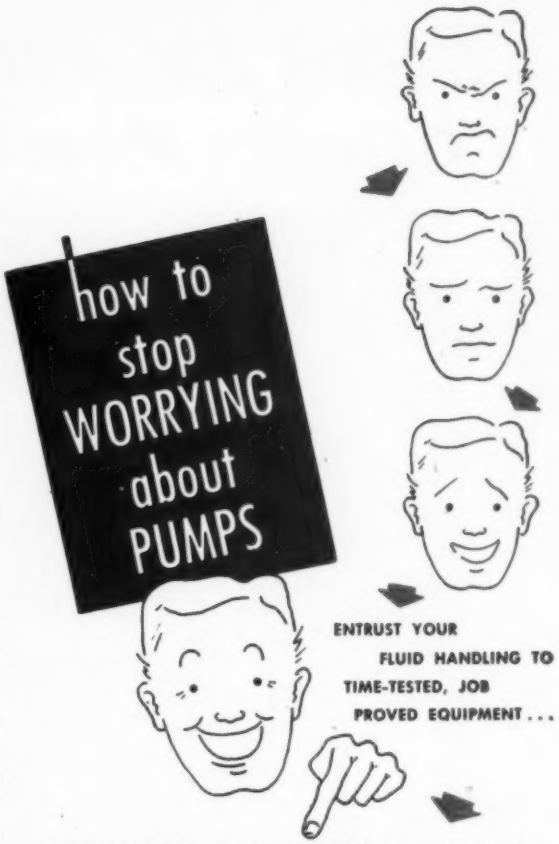
Back issues of Industry and Power may now be obtained on micro film from University Microfilms, Ann Arbor, Michigan. An entire volume is contained on a single roll which can be made for about the same cost as that of binding a year's issues. This should be a boon to libraries who hesitate to destroy periodicals and yet lack space to store them after they are several years old. Inquiries concerning this service may be sent to University Microfilms, 313 N. First St., Ann Arbor, Michigan.

Materials Handling Features Outstanding in New Plant

Many outstanding features in the handling of materials are employed in the Atlanta Paper Company's new one and a half million dollar plant. The eight-acre building has its own interior transportation system, consisting of an over-

head crane and seven gas and electric fork lift trucks. The crane platform glides across a vast storage pit of 7000 tons capacity, so that roll stock may be lifted in for storage or removed into machines in departments adjacent to the pit.

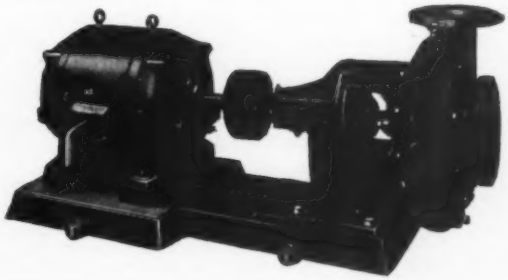
(Continued on page 157)



WEINMAN CENTRIFUGAL PUMPS

With a Weinman Pump on duty you can give your full attention to other plant problems, for Weinman Pumps take care of themselves. Their sturdy construction, advanced design and efficient operation guarantees overall pumping economy.

If your plant handles liquids in any form it will pay you to talk "pumps" with Weinman. A letter, wire, or telephone call will get the prompt attention of a centrifugal specialist — anxious to be of service.



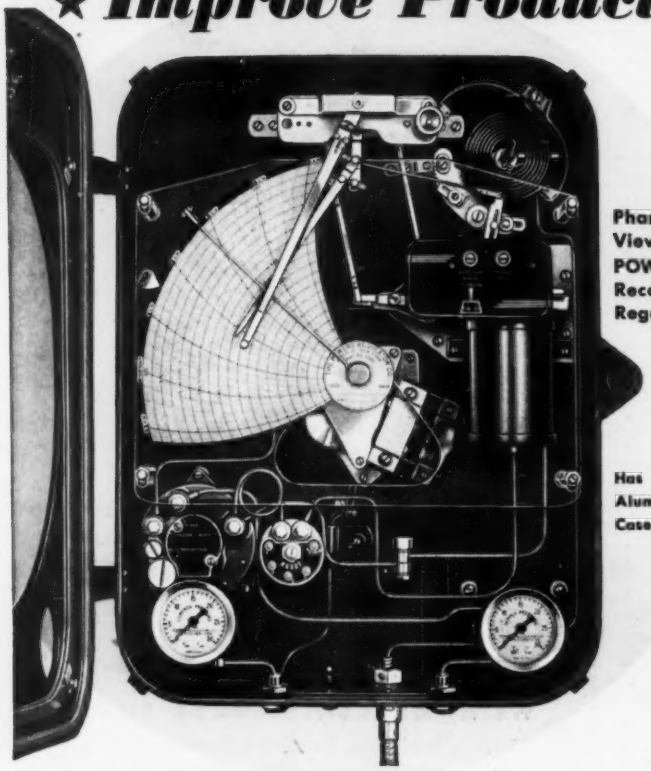
Weinman Type GB and KB Pumps available with or without leak-proof mechanical shaft seals. Heads up to 200 ft. Capacities up to 1100 GPM.

Built by Centrifugal Specialists

The WEINMAN Pump Mfg. Co.

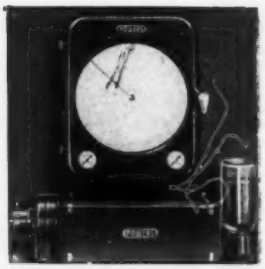
286 Spruce Street • Columbus 8 • Ohio

★ REDUCE COSTS
★ Improve Production

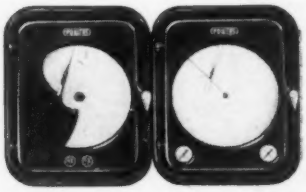


Phantom View of POWERS Recording Regulator

Has Aluminum Case



ABOVE: POWERS WET and DRY BULB RECORDING REGULATOR. Also available as a recorder only. Unit consists of two pen recording thermometer, water pan and motor blower causing sufficient circulation to give proper wet bulb readings.



ABOVE: POWERS TIME CYCLE RECORDING REGULATOR. Cam with cam follower operates steam control valve to correspond with any pre-determined time temperature schedule. Recording thermometer chart record provides a check on the operation of the control.

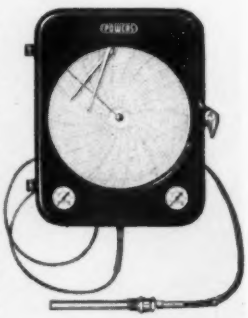
with precision control by—

POWERS

Air-Operated
INDICATING AND RECORDING REGULATORS

For TEMPERATURE • HUMIDITY • PRESSURE

End losses caused by OVER-heating of processes or operations requiring precise control. Install POWERS pneumatic regulators. Their accurate control helps to improve quality of products—speed up production and save steam wasted by overheating.

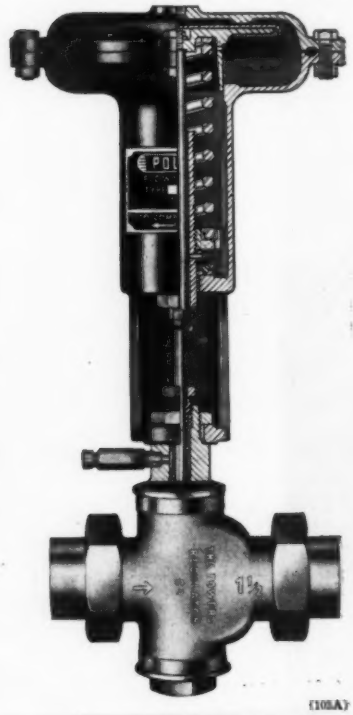


Variety of Models: Recording Thermometers; Recording Regulators; Indicating Regulators; Wet and Dry Bulb Recording Regulators; Time Cycle Recording Regulators; Master and Sub-Master Indicating and Recording Regulators, etc.

Write for Bulletin 370.

For Better Temperature and Humidity Control and valuable aid in selecting the right instruments for your requirements—phone or write our nearest office. There's no obligation. The Powers Regulator Co., 2777 Greenview Ave., Chicago 14, Ill. • 231 E. 46th St., New York 18, N.Y. • 1808 W. Eighth St., Los Angeles 5, Calif.

THE POWERS REGULATOR CO. • OFFICES IN 50 CITIES



ABOVE: POWERS FLOWRITE VALVE

Oil From Sandstone

(Continued from page 79)

Overflow from the mixer enters a cone-bottom settling tank containing hot wash water. Additional mixing is obtained by means of a paddle that revolves at one revolution per minute. Sand and most of the water and silt settle out from the diluted bitumen as an oily sludge, which is pumped back to the pulper for further processing. The partly settled oil rises and overflows to the final settling chamber. Volume of the initial settling tank and the rate of flow through it are such that the solution does not remain in the tank long enough for all the water and silt to settle. Consequently, provisions for further settling are necessary. In the final settling tank virtually all of the water and silt settle in a period of 12 to 16 hours. The final settling temperature is 200° F.

Separation

Separation of bitumen from bituminous sandstone by the action of heated water is not a new development. Early attempts to recover hydrocarbons by this method were made about thirty years ago in this and other countries. However, because of the lack of knowledge of the fundamental principles underlying efficient separation, displacement of the bitumen from the sand grains was usually incomplete and considerable bitumen was retained in the sand tailings. Furthermore, the separated bitumen frequently contained large percentages of sand and water.

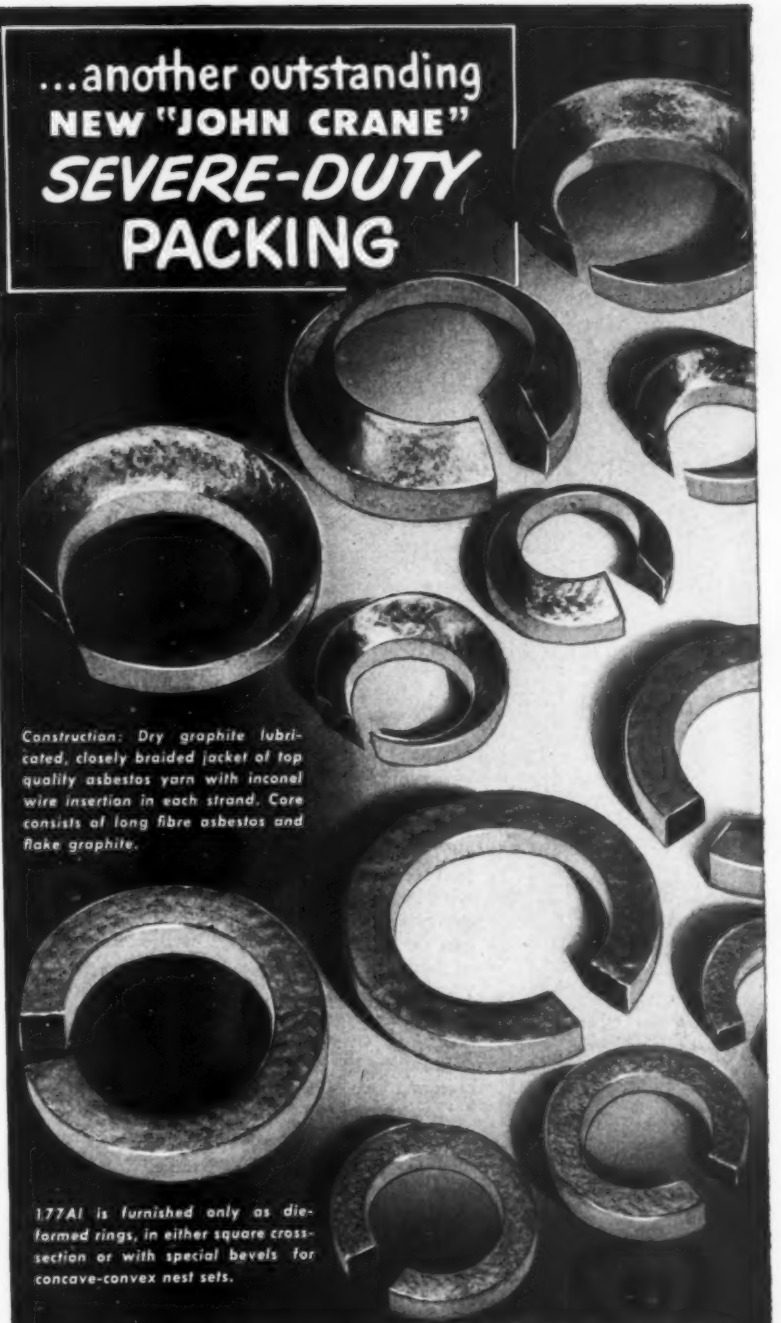
Many of the former difficulties have been overcome and on several of the latest laboratory runs, in which optimum operating conditions were maintained, 95% of the bitumen originally contained in the samples was recovered. The recovery percentage is based upon an average bitumen content of Edna sandstone of 11%. Loss of 5% (1% to tailings and 5% to the slimes) of the original bitumen of the Edna samples can normally be expected. This loss may be attributed in large measure to the fineness of of some bitumen particles which combine with the iron hydroxide and fine silt in the pumping operation and are not floated in the separation cells with the recovered bitumen.

Expansion Joints

(Continued from page 93)

bellows joint of much less wall thickness is installed. This complaint is logi-

...another outstanding
NEW "JOHN CRANE"
SEVERE-DUTY
PACKING



Construction: Dry graphite lubricated, closely braided jacket of top quality asbestos yarn with inconel wire insertion in each strand. Core consists of long fibre asbestos and flake graphite.

177AI is furnished only as die-formed rings, in either square cross-section or with special bevels for concave-convex nest sets.

177AI— for EXTREME PRESSURES, TEMPERATURES to 1200°F

If you have a high temperature packing problem on steam valves, soot blowers, gauge glass fittings, etc., you need this new "John Crane" packing. It remains resilient at high temperatures, it will not harden, even at 1200°F, and it easily withstands pressures as high as 2000 psi.

Style 177AI is the newest in the extensive "John Crane" line of quality packings. If you don't have the complete "John Crane" catalog, you should write for it—its recommendations can be a real help.

JOHN CRANE
CRANE PACKING COMPANY
1831 CUYLER AVENUE • CHICAGO 13, ILLINOIS
Offices in All Principal Cities in United States and Canada

YARWAY
IRON
Easy
TO SERVICE
• A good strainer protects your equipment and pipelines.
Maintenance men said "give us a strainer with a blow-off cap that comes out easily and makes up tight; a screen that can be put back in place without a lot of fiddling around".
• The easy-to-remove Yarway cap meets these requirements. It has straight (not tapered) thread, machined face and spark-plug-type gasket. Permits easy removal for cleaning. Insures proper screen alignment when replaced in body.
• Screen itself is of high grade woven monel wire, or perforated if desired.
• Body of strainer is iron or steel, cadmium-plated for protection against corrosion and for better appearance.
• Available in six sizes, ½" to 2", for pressures to 600 lbs. Reasonably priced. Hundreds of thousands in use. Stocked and sold by 150 Mill Supply Houses.
• See your dealer or write for Bulletin S-201.
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YARWAY STRAINERS
"Police the Pipelines"

cal and unless the joint is made from superior alloys, such reductions cannot be tolerated. The fabricator of the bellows must be given the pressure, temperature, and chemical characteristics of the material being handled if he is to supply a satisfactory expansion joint. Internal alloy sleeves can be used to protect the wrinkles from erosion and external bands or keepers to reduce the hazard from mechanical damage. A recent development is the jacketed metal bellows joint, Fig. 13, which places the pressure on the outside of the wall and can be construction for any pressure. This is a decided advantage when highly corrosive materials are being handled. The element is completely protected and the pipe forms its own inner liner.

Sensibly applied, expansion joints have a place in high pressure piping systems, and maintenance for well designed correctly applied joints, in both high and low pressure service, is proving remarkably low in cost.

Acknowledgment is made to E. H. Ziebold, chief engineer, Magnilastic division, Cook Electric Co.; H. C. Woodward, Yarnall-Waring Co.; W. A. Sherbrooke, president, Piping Specialties, Inc.; and W. L. Benson chief engineer, Badger Fire Extinguisher Co. for information and assistance supplied in the preparation of this article.

Controller Maintenance

(Continued from page 97)

sluggish action of contact mechanisms with consequent burning of contacts.

Symptoms

When trouble develops in a control circuit, usually certain clues will point to its cause. By becoming familiar with various trouble symptoms and their cause, remedies can quickly be decided upon. The following troubles are representative:

Contact chatter, caused by poor contact in controller operating circuit, excessive jogging, broken pole shade coil, or slamming of contactor.

Short contact life may be caused by jogging when the controller is not designed for such service. Since contact life varies approximately in inverse proportion to the square of the current interrupted, jogging may wear contacts more than 30 times as fast as ordinary stops from full speed. Jogging may also cause welding of the contacts.

Contact Failure

Failure of contacts to close can be due to low voltage, defective controller operating circuit including external push buttons and switches, defective

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Protect Modern Machines against Costly Delays

TRIPLES PRODUCTION SPEED

● This Gisholt Turn Mill has two milling cutters that work in pairs, and progressively mill the pin diameters and adjacent cheeks on an automobile crankshaft, three times as fast as the previously used system.

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Your Electrical Circuits Need ECONOMY Modern "De-Lay" Protection

Why risk needless stoppages of your time-saving and cost-reducing equipment, due to needless "blows" caused by momentary overloads?

ECONOMY "De-Lay" FUSES offer superior protection against unnecessary "blows" within the 135 to 200% range, where most overloads occur.

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Loading racks are safer...take more abuse longer... when built with CHIKSAN Ball-Bearing Swivel Joints.
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It's safer...and less expensive ...to insure safety all the way in your loading and unloading lines. With CHIKSAN Ball-Bearing Swivel Joints, you get the same strength...the same safety ...the same protection throughout your entire piping system because you can build your own flexible loading and unloading lines with pipe and fittings of the same strength and long life as you design and build into all other parts of your piping system. You eliminate all weak links! You eliminate all the variable hazards which increase with age and usage in all types of fabric or flexible metal hose.
Play safe all the way! Use CHIKSAN Ball-Bearing Swivel Joints to make up your loading and unloading lines. With them, you get unlimited flexibility with the strength, long life and safety of steel. You get greater protection...greater safety ...and greater economy with CHIKSAN.
Eliminate fire and explosion hazards in lines handling Liquified Petroleum Gases by using CHIKSAN Ball-Bearing Swivel Joints and all-steel lines.
CHIKSAN's Engineering Department will gladly assist you in designing flexible lines to suit your individual needs. This Service is based on 25 years of experience in designing and developing Ball-Bearing Swivel Joints for every purpose.
Transfer lines using CHIKSAN Ball-Bearing Swivel Joints save cost of extra valves and fittings...eliminate contamination losses.
CHIKSAN ALL-METAL Marine and Barge Hose is easier to handle...safer...and more economical.
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BALL-BEARING SWIVEL JOINTS FOR ALL PURPOSES

coils, or open overload relay contacts.

If contacts do not open, look for welded contacts, ground on holding circuit, misalignment of parts, or gummy deposits on magnet faces. Sluggish controller operation may be caused by low voltage, contact springs too strong, excessive friction, or misalignment of parts.

Overload Relays

Overload relay troubles arise from a variety of faults. Consult the instruction sheet covering the specific type of relay.

Overheated resistors may be the result of under rating, failure of contacts to close, or insufficient ventilation.

Sometimes controllers will operate when not wanted. This is usually due to sneak circuits or grounds on the operating circuit.

Manual Controllers

Manual controllers are more simple than magnet-operated controllers but are subject to some operating difficulties. At times an operator will manipulate a manual controller so rapidly that the motor is practically started across the line. This results in excessive burning of contacts or flashover.

Instruct operators of manual controllers in the proper method of starting motors, so as to prevent bringing the motor up to speed too rapidly, or stopping at a mid-point and allowing the starter resistors to overheat.

Contacts of manual controllers should be kept smooth with sandpaper, but no more metal should be removed than necessary. Sharp projections on contact surfaces may be filed level with the surface. All types of actual sliding contacts should be kept clean and lubricated with a very light coat of vaseline. The bearings also require lubrication.

Spring Pressure

Contact spring pressure should be sufficient to prevent contact arcing. The star wheel lever spring on drum controllers should have enough tension to serve as a feeler in centering the contact.

If low voltage release coils fail to hold, the trouble may be due to low voltage, or use of an incorrect coil. Where a manual compensator low voltage release drops out due to voltage dips, the installation of a time delay low voltage release assembly will correct the trouble. To operate properly magnet faces of low voltage release mechanisms must be free of dirt and rust.

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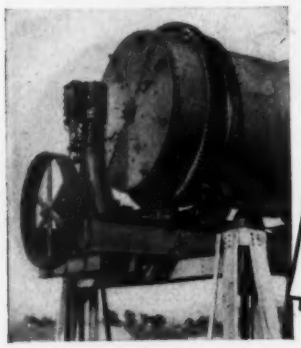

Year after year: Up in the air, out in the open, the Troy Steam Engine continues to drive this kiln in an asphalt paving plant after many years of dependable operation.

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BOOK REVIEWS

Radioactive Waste Handling

Recent booklet issued by the Atomic Energy Commission contains a non-technical report on the safe handling of radio active wastes in the atomic energy program. The report describes radioactivity and its biological effects, types and sources of radioactive wastes, and safe methods of handling wastes.

Important subjects covered are: The Meaning of Radioactivity; Types and Sources of Radioactive Wastes; Safe Handling of Radioactive Wastes in the Atomic Energy Industry; and Safe Handling of Wastes Resulting from Radioisotopes Distribution Program.

"Handling Radioactive Wastes in the Atomic Energy Program" published by the United States Government Printing Office. Superintendent of Documents, Washington D. C. Price 15 cents.

Water Supply Engineering

Technical and research fundamentals concerning treatments, distribution, design, construction, operation, and maintenance of water supply systems are contained in the fourth edition of "Water Supply Engineering" by H. E. Babbitt and J. J. Doland. Every phase of theoretical and practical aspects of water engineering is treated.

Special new topics in this revised issue include: (1) hydraulics, such as underground water flow, well construction and maintenance, rainfall, runoff; (2) electrical equipment and pumps; (3) Intakes, aqueducts, and pipe lines; and (4) new coagulants, valuable data on storing, handling, and mixing chemicals. This book covers the subject of water supply and distribution in logical steps, stressing practical applications of natural laws and engineering principles. Illustrations, working data, and problems are freely employed.

"Water Supply Engineering" by Harold E. Babbitt and James J. Doland. Published by McGraw-Hill Book Co., Inc., 330 West 42nd Street, New York 18, N. Y. 593 pages. 258 illustrations. $6.50.

Electrical Insulation

Pocket size book, covering the history and development of electrical wire and cable insulation, is written to serve as an authoritative reference on varnished insulations. Information and data were obtained from the major manufacturers of varnished insulation and compiled by David O. Woodbury. Nature and purpose of varnished insulations are carefully described. The applications of varnished insulations in rotating apparatus, transformers, cables, power distribution systems, motor controllers, high-tension magnetos, and electronic equipment are discussed in an easy to read manner.

Contents of the book are divided into two parts "History and Background", which contains the nature, purpose, and insulations of yesterday and today, and uses of varnished insulations.

"The V. I. Story—Varnished Insulations in Electrical Engineering" by David O. Woodbury. Published by National Electrical Manufacturers Association, 155 East 44th Street, New York 17, N. Y. Illustrated. 88 pages. $1.00.

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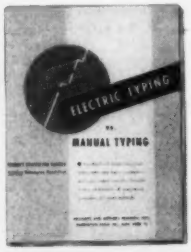

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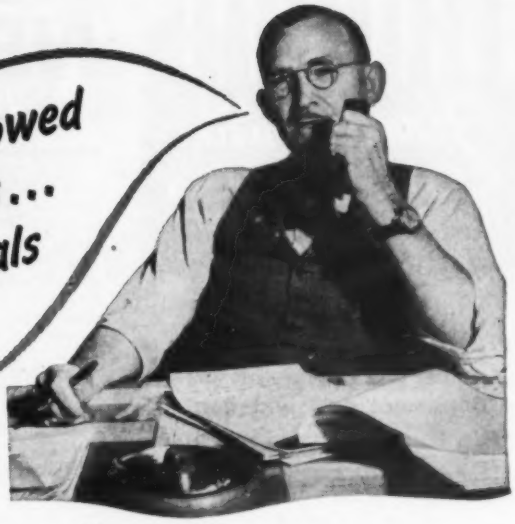
Chief Research Engineer Reports on Valve Trim Materials

"S" Monel consistently showed better anti-galling properties... than any of the other metals we have tested...



Albert D. Eplett

These are the words of Albert D. Eplett, chief research engineer of MANNING, MAXWELL & MOORE, INC., Bridgeport, Conn.

As a result of controlled laboratory tests made under his direction over a period of years, "S" Monel* is now standard material for guide sections in four types of Consolidated Safety Valves.

Here Mr. Eplett tells you about one of the actual tests:

"We carried out our anti-galling tests," he says, "by building a small valve identical to the larger ones ordinarily used. We devised a cam-operated mechanism that would give us lifting characteristics similar to those that occur with steam. Superheated air was carried in through the nozzle and up over the disc and guide portions, where we located thermocouples. When galling occurred, a cut-out device shut off the operating mechanism.

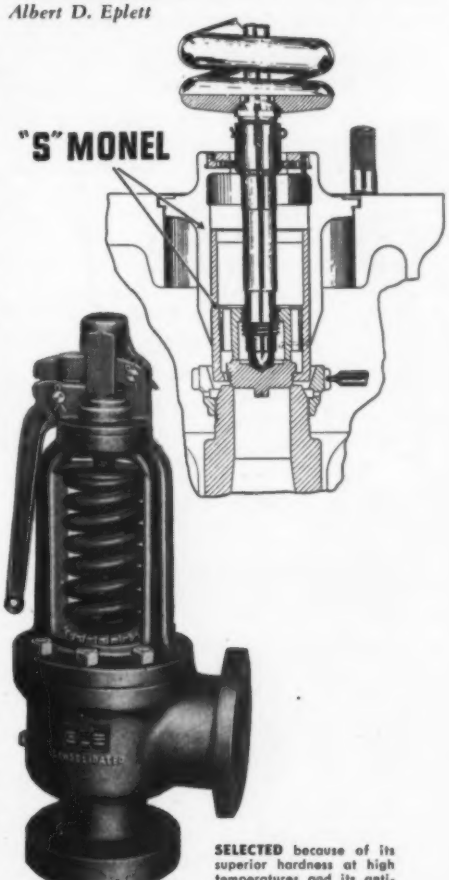
"By this method, we have tested a great number of valve trim materials, including the so-called super alloys. ***And we discovered that "S" Monel consistently showed better anti-galling properties in combinations with other metals and against itself than any of the other metals we have tested*** – excluding, of course, hard facing alloys, which are not as economical to use."

"S" Monel, in addition to its non-galling characteristics, has the well-known properties and advantages of *all* INCO Nickel Alloys. ***It is strong . . . tough . . . fatigue resistant . . . corrosion resistant.*** It simplifies fabrication and offers economies in valve trim for high temperature service; it is an outstandingly efficient material for heat-treated engine castings, hot air scoops, fuel line fittings, pump liners, fuel and oil tank flanges, wing hooks, etc.

DO THIS – NOW

Get more information about extra-hard heat-resistant "S" Monel and other specialized valve materials. Write to R. F. Johnson, c/o The International Nickel Company, and ask him to send you INCO's valuable booklet, ***Trimming Valve Costs with Lasting Trim.*** It tells you how to make valves last longer, whether they handle live steam, hot chemicals, compressed air or corrosive cooling water. Send today for your free copy. A post card will do.

*Reg. U. S. Pat. Off.



SELECTED because of its superior hardness at high temperatures and its anti-galling properties, "S" Monel is now standard material for guiding sections (arrows) in this Manning, Maxwell & Moore Consolidated Safety Valve. Used in the hardened state, the "S" Monel parts cast at Inco's foundry are given a ground finish with an emery cloth polish prior to assembly.

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REQUIRE NO MAINTENANCE

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Specialists on Couplings for more than 30 years

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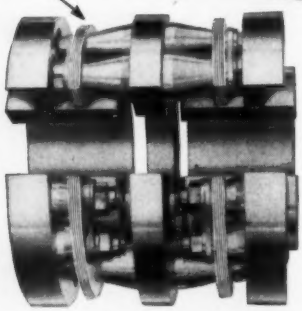

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ALL PARTS ARE SOLIDLY BOLTED TOGETHER.

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NEWS...
of men and companies

Springfield Boiler Co. — Announcement of the appointment of H. S. Colby as assistant to the president has been made by G. R. Atherton, president. Mr. Colby is widely known in the boiler and steam generating field having been identified with such companies as Riley Stoker Corp. and Combustion Engineering Co. Announcement is also made of a new sales representative for Springfield water tube boilers in the Missouri valley and western plains area north of Texas, including the Rocky Mountain area and the states of Wyoming, Montana and North Dakota. This is the Power Equipment Co., located at 4706 Holly St., Kansas City, Mo.

Elgin National Watch Co.—Wm. M. Brandes, director of manufacturing, has been elected vice president according to an announcement by J. G. Shennan, president. Simultaneously, the board of directors announced the election of Andrew L. Rowe as vice president to succeed Howard D. Schaeffer, who has retired after 46 years.

Johns-Manville Corp.—Appointment of Phillip D. Cannon as vice president of Johns-Manville Products Corp. and production manager of the industrial products division has been announced by J. A. O'Brien, vice president and general manager of the division which operates 11 plants throughout the United States.

Chain Belt Co. of Milwaukee—Appointment of four new distributors has been announced by the company. The Winn Supply Co. of 256 Seventh Ave., San Diego, Calif. and the Arkansas Bearing Co. of Little Rock, Ark. have been made distributors for the merchandise products of the Chain and Transmission, Baldwin-Duckworth and Conveyor and Process equipment divisions of the company. The Pacific Hardware & Steel Co., Inc., San Jose, Calif. and the Polsom Implement Co. of Seattle, Wash. have been appointed distributors for the Chain and Transmission and the Baldwin-Duckworth divisions.

Minneapolis-Honeywell Regulator Co.—James H. Binger has been elected vice president and general manager of the Belfield Valve Division, Philadelphia. He will be in charge of manufacturing and engineering in the valve division, as well as coordination of the sale of valves through Brown Instruments and other divisions. He joined the company in 1943.

Kaiser Aluminum & Chemical Sales, Inc.—Appointment of A. S. Basil as assistant general sales manager to direct the national sales of the company's electrical wire and cable products has been announced by general sales manager, Bert Inch. Headquarters for the sale of the company's electrical conductor products is being established at the cable, rod, bar and wire plant at Newark, Ohio. At the same time H. W. Biskeborn, who has been a member of the production department, is transferred to electrical cable sales as technical director. A new product sales office is being established at Chiago, with offices in the Palmolive Building.

A. S. Basil

A. L. Larson

The Falk Corp.—Thomas F. Scannell, general sales manager, has announced the appointment of Arthur L. Larson as assistant to the sales manager and the appointment of Wm. J. Urban as manager of coupling sales. The new manager of distributor sales is Don K. Lambert. Roland E. Govan heads sales promotion, a newly organized department; assisting him are Eugene H. Millmann and A. H. Kelley.

Controlled Circulation Audit, Inc.—Frank L. Avery, managing director for the past 18 years, died at his home in Ridgewood, N. J., on January 20th after a long illiness.

(Continued on page 130)

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FOR CARBOYS, DRUMS AND BARRELS

A smooth flow starts quickly . . . no dangerous spurts or splashes. Lifting and tilting of container no longer necessary. No dangerous pressure develops and flow can be instantly stopped.

Equipped with flexible Saran tube and adapter for openings larger than 2¼" dia. Long life even when used with most corrosive liquids.

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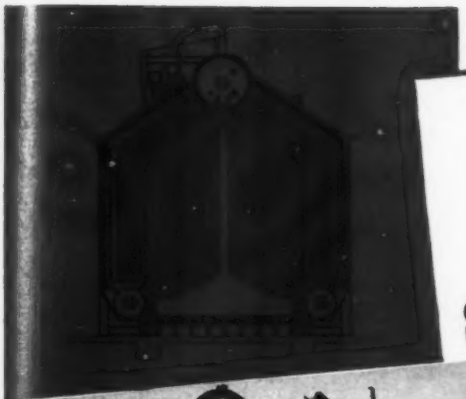
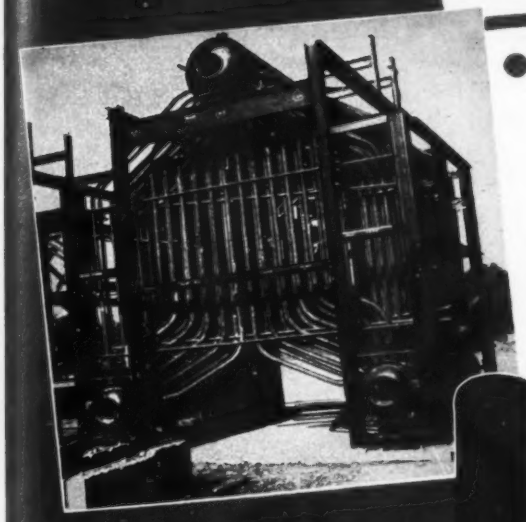
NEW COMPLETE 1950 SAFETY CATALOG SENT FREE ON REQUEST

UNION
"H" TYPE
STEAM GENERATOR





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THESE photos tell their own story of the adaptability of the Union "H" Type Steam Generator . . . the Ideal Outdoor Installation.

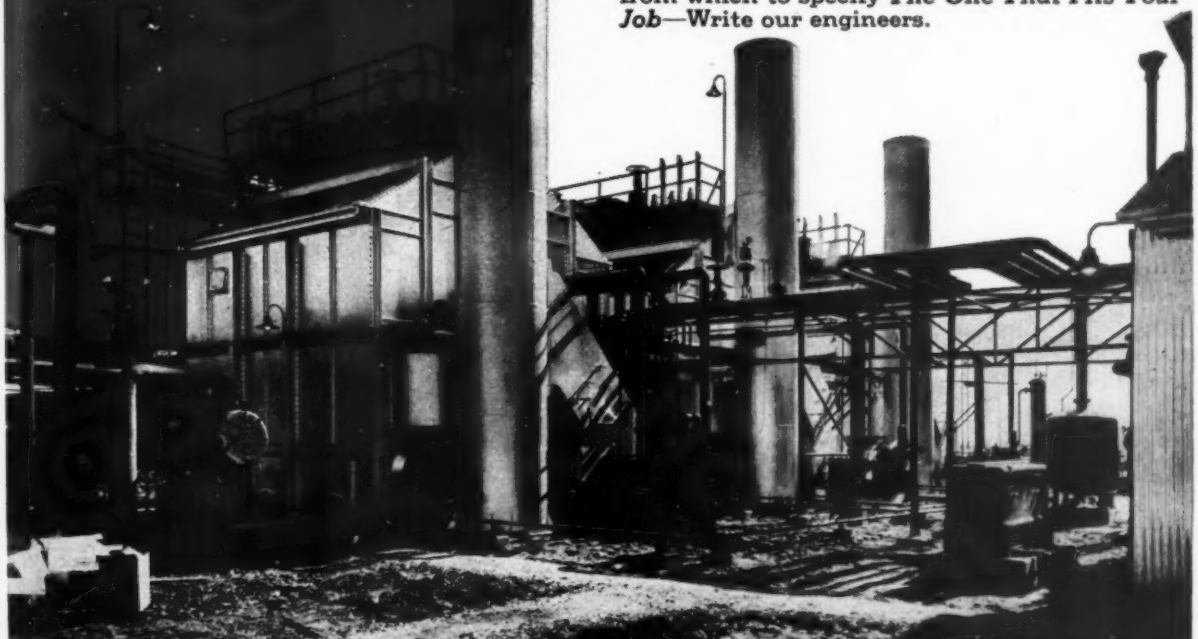
❶ Compact, simplified design in a steel clad insulated setting with furnace inside the unit.

❷ Drum and tube arrangement symmetrical . . . a tube bank on each side forming an integral water cooled furnace. No headers . . . No handhole plates required.

❸ Superheater on one side only provides (patented) simplified superheat control over a wide load range for all fuels and varying excess air. Automatic adjustment of boiler outlet dampers controls gas flow across superheater.

❹ Design accommodates any fuel or firing method for any desired capacity or pressure.

There are 13 basic Union boiler designs from which to specify *The One That Fits Your Job*—Write our engineers.



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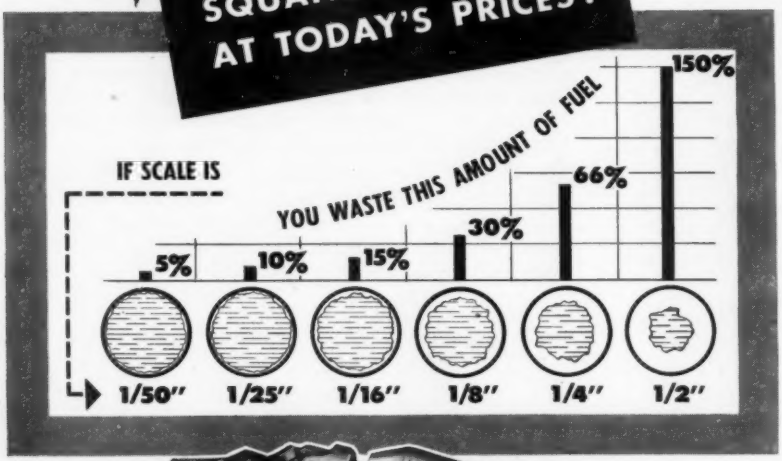
coal prices more than DOUBLE in 10 years

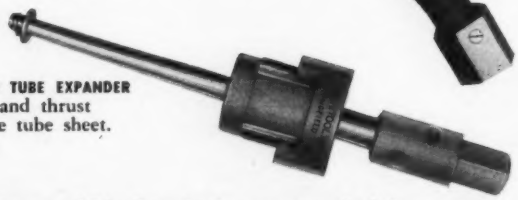
It takes more than twice as many dollars to fire your power plant today as it did 10 years ago. And if you allow your tubes to become coated with scale deposits it's amazing how much additional coal you need.

Carefully examine the chart below and you'll agree that regular AIRETOOL tube cleaning and maintenance mean a big saving in fuel dollars. By removing a ½" coating of scale, you make one ton of coal do the work of two and a half. For further information on tube cleaners, tube expanders and accessory tools and how they save you money, write The AIRETOOL Mfg. Co., 318 S. Center St., Springfield, O.

can you SQUANDER COAL AT TODAY'S PRICES?



AIRETOOL BOILER TUBE CLEANER
for removing fuel wasting scale from straight or bent tubes.



AIRETOOL NO. 164 BOILER TUBE EXPANDER
has 3 expanding rolls and thrust collar that bears on the tube sheet. For tubes 1" to 4" O.D.

There's an Airetool Tube Cleaner and Tube Expander for every type of tubular construction.

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(Continued from page 128)

Midwest Stoker Association—At the annual meeting, F. H. Herndon, president of Herndon Sales & Service Co., was elected president of the association for the ensuing year. He succeeds E. W. Jones, office manager of the Iron Fireman Mfg. Co., Chicago.. Other officers elected for the year are P. I. Bohmann, regional manager of the U. S. Machine Corp., vice president and Charles H. Wilson, manager of Park Heating Sales, secretary-treasurer. These three officers were also elected directors together with E. W. Jones, Iron Fireman Mfg. Co., and E. J. Worley, Stoker Service Co.

Southern Coal Company, Inc.—Thomas J. Tarzy, formerly manager of industrial sales for the Chicago branch office, has been appointed district manager upon the retirement of A. W. Hawkins. Mr. Tarzy joined the company in 1941 as a fuel engineer and maintains headquarters at 333 N. Michigan Ave., Chicago.

T. J. Tarzy

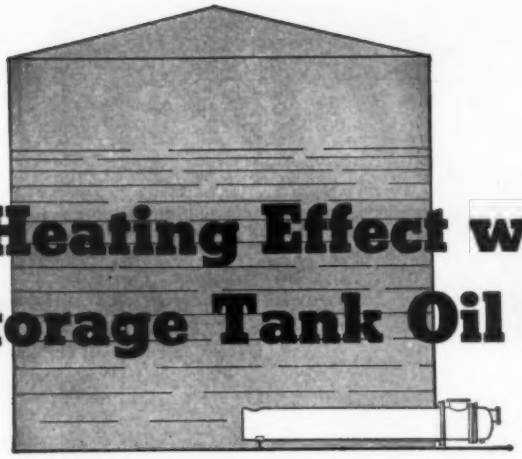
Westinghouse Electric Corp.—Mr. O. O. Rae has been appointed manager of the company's Southeastern District to succeed Mr. Thomas Fuller who is retiring after 44 years. Mr. Rae has been with the company since 1919. Establishment of three new sales units within the Central District, Westinghouse Lamp Division, has been announced. Ray C. Daugherty has been appointed manager of the Pennsylvania-Ohio Lamp Sales Division with headquarters at 419 Wood St., Pittsburgh. Harry A. Kinley has been named manager of the Michigan Lamp Sales Division with headquarters at 5757 Trumbull Ave., Detroit. Howard J. Thomas has been made manager of the Ohio Valley Lamp Sales Division. His new office is at Third and Elm Sts., Cincinnati.

Link-Belt Company—Announcement is made of the opening of a factory branch store and warehouse in Kansas City, Mo., at 2630 Holmes St. Conveying and power transmission machinery parts, chains, sprockets, bearings, speed reducers, and elevator buckets will be carried at the new address for the benefit of customers in that area.

Dodge Manufacturing Corp.—Roy T. Jewell, 57, superintendent of maintenance for 14 years, died January 1, after an illness of three years.

Worthington Pump and Machinery Corp.—Appointment of A. M. Boehm as eastern manager, engine division, has been announced. He will handle sales negotiations for gas and oil pipe lines equipment and oil and gas engines for all services, making his headquarters

(Continued on page 132)



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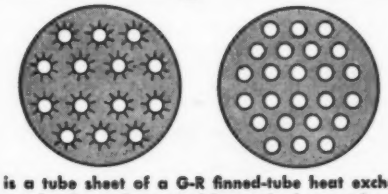
1.

Greater Access of Oil to Heating Elements



At left is a tube sheet of a G-R finned-tube heat exchanger. At right is a tube sheet of a typical bare-tube heat exchanger. Note the greater access space between tubes in the G-R exchanger.

2.

Greater Heating Surface of G·FIN Elements

Even in sub-zero temperatures, the G-R G-Fin Storage Tank Oil Heater assures a steady flow of oil soon after the steam is turned on. That's because (1) the wider tube spacing allows the viscous oil greater access to the tubes than in a conventional heater and (2) the G-Fin elements provide six to eight times the heating surface of bare tubes.

Greater heating effectiveness is only one of the important reasons why users prefer the G-R G-Fin Storage Tank Oil Heater. These units use less steam because they heat oil only locally at point of withdrawal. The straight-through flow of oil results in minimum pressure drop. There's no stratification or vapor binding because the oil outlet is located at the top of the shell. And there are fewer tubes and tube joints to maintain.

These and other advantages of the G-Fin Storage Tank Oil Heater have been fully proved in thousands of installations. Write for Bulletin 1642 describing these units in detail.

TYPICAL APPLICATIONS OF G-R G-FIN STORAGE TANK OIL HEATER

STORAGE TANKS—containing heavy oils, tar or asphalt at refineries, tank farms, etc.

SERVICE TANKS—serving oil-burning boilers at central power stations, industrial plants.

LOADING WHARVES—to speed up transfer of oil to and from tanks, lighters, barges or cars.

CHEMICAL PLANTS—wherever viscous oil or other liquids must be transferred in bulk.

GAS PLANTS—where by-product tar or heavy oils must be heated.

MISCELLANEOUS—for heating cottonseed oil, molasses, road oil and other viscous liquids.

THE GRISCOM-RUSSELL CO., 285 MADISON AVENUE, NEW YORK 17, N. Y.

GR-223

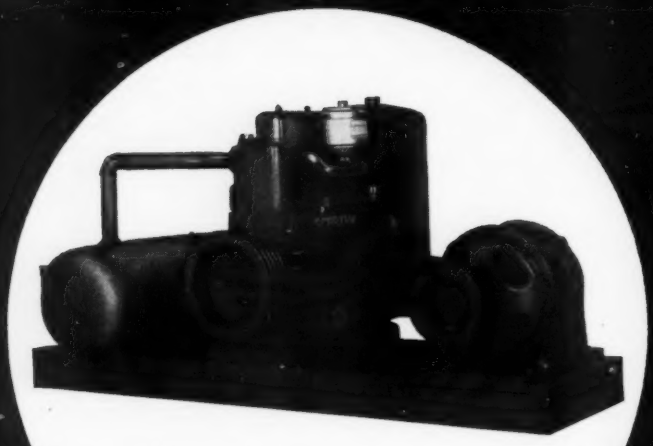
GRISCOM-RUSSELL

PIONEERS IN HEAT TRANSFER APPARATUS

Unistage

RESULT OF

50 Years of Dependable Service



Model 105 *Unistage* Compressor on base with Motor, horizontal air receiver and cooling unit.

FOR PRODUCTION and MAINTENANCE
FOR SPEEDY PNEUMATIC TOOLS

SCHRAMM INC. offers a complete line of Industrial Compressors in sizes ranging from ... 2 to 600 cubic feet displacement... Built and designed for continuous heavy duty service with a minimum of attention.

Available in "V" or Flat Belt Drive... on base for belt drive from motor or engine ... or, with direct motor drive. No special foundation required... can be bolted to any substantial floor.

Where running water is not available the SCHRAMM Cooling Unit will prove adequate under severest conditions. Accessories essential to any modern industrial installation can also be provided.

Write for Bulletin # 4910.

Important Features

- Compact... Easy to Install
- Mechanical Intake Valve
- Force Feed Lubrication
- 100% Water Cooled
- Electric Push Button Starting
- En Bloc Construction
- Easy Accessibility
- Vibrationless
- More Bearing Surface

SCHRAMM INC.

THE *COMPRESSOR* PEOPLE • WEST CHESTER • PENNSYLVANIA

(Continued from page 130)

at the New York district office. Mr. Boehm who has served the company for 25 years as an engine sales specialist succeeds W. L. Russell who has been assigned to handle Canadian sales for the John Inglis Co., Worthington's Canadian Associate. Appointment of Harry E. Lewis as assistant comptroller to succeed Joseph A. Schallenberg who died December 16, 1949 has also been announced. Mr. Lewis joined the corporation in 1924.

The Cleveland Chain & Mfg. Co.—Formation of the Round Chain & Mfg. Company, a new associate of the five other Round Chain plants, was announced recently by James W. Dickey, vice president and treasurer. Affiliated with The Cleveland Chain & Mfg. Co., The Bridgeport Chain & Mfg. Co., Round California Chain Co., Seattle Chain & Mfg. Co., and Woodhouse Chain Works, Trenton, N. J., the new company will be located at 646 W. Lake St., Chicago. John F. Ansink, former district manager of the Cleveland company, will be general manager.

J. F. Ansink

Heller Brothers Co.—George H. Hodapp was recently elected president of the company according to an announcement by Arthur C. Heller, chairman of the board. Mr. James G. Henry, Jr., was elected vice president and secretary, Miss Anna W. Ibach, treasurer, and Eugene M. Steenburgh, assistant secretary. Mr. Hodapp becomes the fifth chief executive of the company, which was founded in 1836.

G. H. Hodapp

Stoker Manufacturers' Association—D. L. Getz, chief engineer of the Steel Products Engineering Co., Springfield, Ohio, has been named chairman of the engineering and research committee of the association. Mr. Getz succeeds Joseph G. Beard who recently resigned.

M. H. Detrick Co.—The Industrial Department of the American Arch Co., Inc., New York, has been purchased by the American Arch Division with offices in the Oliver Building, Pittsburgh. Former executive personnel have been retained to operate the division.

Laclede-Christy Co.—Announcement is made that refractory users in Oregon, Washington, Idaho, Alaska, and certain export territories may now obtain various qualities of fireclay brick, special hand-molded shapes, some arches, and wall tile from Abbotsford, B. C. This

(Continued on page 134)

We're not out to corner the DAMPER MARKET...

. . . we want HEACON DAMPER applications that will pay for themselves in 6 months.

The Heacon Damper is not just *another* damper. It is designed and engineered to provide the tightest closure possible under all conditions. Each damper is developed to solve a specific problem, each provides the ultimate in control.

The dampers shown on this page all solved specific problems that could have been solved in no other way.

As an example, the second damper from the left above, not only controls 80" w.g. pressure, but also acts as an automatic reverse flow valve that instantly closes and prevents leakage should one of two fans on the boiler fail. The next damper on the right isolates its air heater for maintenance while the boiler continues in service. Such applications save many times their cost, in time and power loss.

Call or write the office nearest you for full details.

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Holbrook & Hunter, 88 Broad St.

BUFFALO 13, NEW YORK
The Johnston Engineering Co.,
1200 Niagara Street

CHARLOTTE 2, N. C.
T. C. Heyward,
1408 Independence Building

CHATTANOOGA 2, TENN.
Edgar A. Rogers,
Chattanooga Bank Building

CHICAGO 6, ILLINOIS
Cochrane Engineering Corp.,
309 West Jackson Blvd.

CINCINNATI 2, OHIO
Ellman Equipment Co.,
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The H. W. Kaiser Company,
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Metrol Company, 5538 Cass Ave.

HOUSTON 1, TEXAS
The J. A. Rossiter Company,
P. O. Box 1095

KALAMAZOO, MICH.
Metrol Company,
420 W. South Street

KANSAS CITY 6, MO.
The Hesler Co., 950 Dierks Bldg.

LOS ANGELES 7, CALIF.
Southport Eng. Co.,
235 W. 32nd St.

MINNEAPOLIS 4, MINN.
Hoyt A. Sevey, 1525 S. 5th St.

NEW HAVEN 5, CONN.
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Herr-Harris Company,
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The Lang Company,
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The Fulcher Company,
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Lee & Freeman, Inc.
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SCHENECTADY, N. Y.
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● Easily handled by one man, this portable, self-priming centrifugal pump is ready for any emergency on a wide range of drainage and water handling jobs.

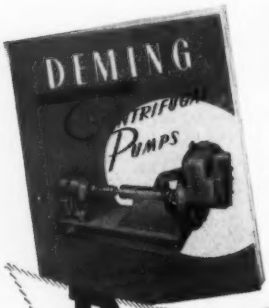
PERFORMANCE RATINGS OF FIG. 3304

Gallons Per Minute	10	20	30	40	50	60	70	80	90
Total Head in Feet	80	75	70	65	57	50	40	30	15

Pump is powered by a Briggs and Stratton, Model "NP", 1½ H. P., four-cycle, air-cooled gasoline engine having high tension magneto. Casing is cast iron. Bronze impeller is mounted directly on engine shaft and has rotary type shaft seal.

Suction is 1½ in. Discharge 1½ in. Length 20 in. Width 13 in. Height 19 in. Weight of pump 83 lbs. Shipping weight 110 lbs.

Send for BULLETIN No. 3300-A for complete details on various types of Deming Self-priming Centrifugal Pumps including the Fig. 3304 Portable type.



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Deming Pumps

(Continued from page 132)

is the conclusion of a long-term agreement with the Clayburn Company Ltd., Vancouver, B. C., enabling Pacific Northwest users to get Laclede-Christy brands at this convenient location, where construction of a modern fire brick plant is being completed.

Graver Tank & Mfg. Co.—Announcement has been made of the appointment of Harry A. Dennis as manager of sales for the company's stainless and alloys division. He will also continue as manager of Weldment sales. Announcement is also made of the appointment of Robert F. Millett as advertising manager.

Lima-Hamilton Corp. — Alfred O. Weiland has been named general manager of the Lima Works. During World War II, Mr. Weiland was vice president and general manager of General Machinery Ordnance Corp., Charleston, W. Va.

A. O. Wieland

W. D. Myers

The Eagle-Picher Company—Walter D. Myers, Jr. has been appointed sales manager of the Industrial Insulation Department following the resignation of Douglas Via, who has joined the King Roofing and Heating Co., as general manager. Mr. Myers has been with the company for five years in various sales capacities.

General Electric Co.—The apparatus Department recently announced new assignments for 10 of its key personnel. Named staff assistants by E. E. Johnson, manager of engineering, Large Apparatus Divisions, were P. L. Alger, Marshall Anderson, T. M. Linville, C. H. Ridgley and F. P. Wilson, Jr. T. D. Foy was named administrative assistant, Small Apparatus Division, by N. M. DuChemin, assistant general manager of the division. Appointed by F. T. Lewis, manager of manufacturing of the same division, were staff assistants F. J. Boucher, D. S. Lisberger, and H. B. Miller. B. A. Case, manager of engineering in this division appointed T. L. Mayes as his staff assistant. Seven executives of the company's Apparatus Department have been named to new positions in the department's Large Apparatus Divisions. The appointments, announced by C. A. Salmonsen, manager of manufacturing of the divisions, include: C. W. Fuller, transferred to the staff of the manager of manufacturing; N. E. Firestone, appointed staff assistant to the manager of manufacturing; K. O. Schulte, appointed manager of wage rate; W. H. Bobear, appointed manager of purchas-

(Continued on page 136)

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THERMOMETERS
For all usual industrial temperature requirements, WESTON thermometers have been widely adopted because of their all-metal ruggedness, their readability, their long-time accuracy and low overall cost. And these same advantages are available for unusual temperature needs, too; in WESTON models designed for alarm or control applications—for indicating highest or lowest temperatures reached since last setting—for precise laboratory requirements. Be sure you have all the facts on the complete line. Ask your jobber or local WESTON representative, or write direct for literature. WESTON Electrical Instrument Corporation, 637 Frelinghuysen Avenue, Newark 5, New Jersey.
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If oxygen corrosion is a problem in your boilers, you will profit from reading Monsanto Technical Bulletin No. O-26. For your free copy, contact the nearest Monsanto Sales Office or write: MONSANTO CHEMICAL COMPANY, Desk B, Organic Chemicals Division, 1743 South Second Street, St. Louis 4, Missouri.

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MONSANTO CHEMICALS AND PLASTICS

SERVING INDUSTRY . . . WHICH SERVES MANKIND

(Continued from page 134)

ing; T. F. Garahan, appointed production manager; K. N. Bush, appointed assistant production manager; A. V. Feigenbaum, appointed supervisor of training, manufacturing personnel. Robert S. Neblett, assistant general manager of the Nucleonics Department, has been appointed business and construction manager of the Knolls Atomic Power Laboratory. In his new capacity, Mr. Neblett will handle all business and contractural relations between the company's atomic power laboratory and the Atomic Energy Commission. Dr. Albert W. Hull, assistant director of the G-E Research Laboratory, who has been credited with the invention of more types of electron tubes than any other man, retired recently. One of the tubes invented by Dr. Hull was the magnetron, later modified and improved by scientists in many countries. During World War II it formed the heart of short-wave radar. Dr. Gorton R. Fonda is another research chemist in the research laboratory who has recently retired. Most of Dr. Fonda's work has been concerned with methods of light production and in the last 10 years with phosphors—materials used in fluorescent lamps as well as in television and radar tubes. A new wire and cable specialist has been appointed and assigned to the department's New York district. He is James D. Lowe, formerly a commercial engineer for the division.

Flexible Steel Lacing Co.—Harold James Racette, sales representative, died at his home in Kansas City on November 28th. He became associated with the Chicago company in 1922 and has been their midwest sales representative since 1934.

The Duriron Co., Inc.—Guy A. Baker has been appointed vice president in charge of manufacturing. Associated with the company for 20 years, Mr. Baker has been assistant to the president and secretary of the company for the past several years. R. Merton Shields has been appointed secretary of the company.

Allegheny Ludlum Steel Corp.—Joseph A. Martino, president of National Lead Co., was recently elected to the board of directors. The two companies have formed Titanium Metals Corp. of America, a jointly owned organization for the development, sale and distribution of titanium metal, its alloys and allied products. Mr. Martino began his career with National Lead in 1916, becoming vice president in 1944 and president three years later.

Hyster Company—Announcement has been made of the appointment of

D. R. Shaffer

J. F. Wright

K. T. Barr

three new district managers of industrial truck sales. Donald R. Shaffer has been promoted to managership of a territory comprising southeastern Canada, eastern Michigan, northern Ohio and southwestern New York. John F. Wright will supervise a large western territory including Alaska, western Canada, Washington, Oregon and parts of Montana and Idaho. The Hawaiian Islands, California, Nevada and Utah will be under the direction of Karl T. Barr.

Rivett Lathe & Grinder, Inc.—Purchase of the entire line of products from Gerotor May Corp., Baltimore, has been announced by the company. All manufacturing and selling operations of the line are being transferred to Boston with no interruption in acceptance and delivery of orders. Gerotor May Corp. is retaining the manufacture and sale of hydraulic pumps and fluid motors at Baltimore.

Gulf Oil Corp.—Charles F. Kottcamp has been appointed to the position of chief fuels and lubricants engineer, turbine and steam power section of the Industrial Products Engineering de-

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LOVEJOY VARIABLE SPEED PULLEYS

Fractional to 8 h.p. Easily installed.
Ratio 3:1, infinitely variable. LOW COST.
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Mfrs. Lovejoy Flexible Couplings and Lovejoy Universal Joints

partment. Mr. Kottcamp was previously employed as assistant to the director of research and also manager of the Dunkirk, N. Y., laboratory of the Locomotive Development Committee of Bituminous Coal Research, Inc.

The Babcock & Wilcox Co.—Stoddard M. Stevens, partner in the law firm of Sullivan and Cromwell, New York, was elected a director of the company at its board meeting, January 26th.

Fairbanks, Morse & Co.—Alan E. Ashcraft, for many years a director and vice president in charge of manufacturing died January 23, 1950 at his home in Kenilworth, Ill. Joining the organization in 1903 Mr. Ashcraft had retired in 1946 after 44 years of service.

Pennsylvania Salt Mfg. Co.—Hugh C. Land, assistant to the production manager has been appointed production manager of the company. In his new capacity he will exercise general supervision over operation of the manufacturing facilities in the parent company, including utilities.

Stone & Webster Engineering Corp.—Frederic N. Bushnell, 82, internationally known for his engineering accomplishments and in 1945 recipient of the New England award of the Engineering Societies of New England, died in Brookline, Mass. on January 23rd. Mr. Bushnell served Stone & Webster for more than 40 years, becoming vice president in 1925 and vice chairman of its board in 1929. He retired in 1947.

United States Steel Corp.—Appointment of Paul E. Thomas as assistant general superintendent in charge of service departments of the Gary steel works of Cargnegie-Illinois Steel Corp., was announced February 1, 1950. Since 1949, he has been assistant to general superintendent.

Taylor Forge & Pipe Works, Inc.—A new subsidiary will be located at Hamilton, Ontario to permit the company to participate actively in the Canadian market for the products of its manufacture. It is hoped that the new plant can be staffed with Canadian personnel.

The Whiton Machine Co.—New appointments include O. D. H. Bentley as consulting engineer on steam turbines and Eugene B. Williams to take charge of the sale of steam turbines for U. S. Navy applications. Both men come from the B. F. Sturtevant Co. of Boston, where Mr. Bentley was chief engineer for many years and Mr. Williams, vice president in charge of sales.

McDonnell & Miller, Inc.—Announcement has been made of the election of George H. LaRoi as vice president and James A. Solon as treasurer of the company. Both men have played important roles with the company for a number of years.

Cutler-Hammer Inc.—Opening of a sales office at 410 W. First St., Dayton, Ohio has been announced. Mr. P. L. Erickson, widely known sales representative in this area, will manage the office as a branch of the Cincinnati district sales office.

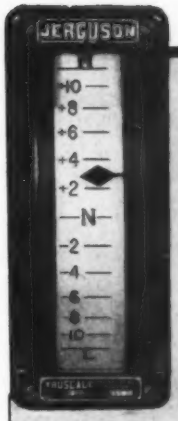
Kennametal Inc.—C. J. Marlett, representative in the Chicago district for the past seven years, has been transferred to the engineering department at Latrobe, Pa. As project engineer he will be engaged in research and development.

J. C. Marlett

C. E. Miller

Combustion Engineering-Superheater, Inc.—Appointment of Carl E. Miller to the engineering staff of the industrial department has been announced. Mr. Miller was formerly technical advisor in research and development on coal, gas, and petroleum technology at Battelle Memorial Institute and served as special consultant on fuels to the Economic Cooperation Administration in Europe.

Arthur D. Little, Inc.—Charles B. Belknap, of the Owens-Illinois Glass Co., has been elected to the board of directors. He has long been active in the administration of industrial research. At the same meeting, Howard J. Billings was elected treasurer, to succeed Henry G. Powning. Mr. Billings will also be in charge of the company's non-technical internal opera-



Assures Positive Distance Reading of Liquid Levels

JERGUSON TRUSCALE GAGE

THE modern design JERGUSON TRUSCALE GAGE gives new accuracy for reading of liquid levels in boilers, deaerating tanks, etc.

Here is the distance reading gage which incorporates all of the newest engineering features! The Jerguson Truscale has exceptional sensitivity, with the ability to register changes as small as ½ of 1% of range! The translucent dial scale is clearly lighted from behind, and is easy to read.

The Truscale Gage may be equipped with positive alarm system. Lights flash and horns sound at specified key points when liquid level falls dangerously low or rises too high. Foolproof anti-surge mechanism for use on ships. Available for panel, pedestal, or wall mounting. It will pay you to investigate.

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Hydrostatic type distance reading gage with inverted U-tube manometer. Water level always visible with space above showing brilliant red. Built-in feature makes possible checking of gage accuracy in few seconds.

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With ROTOJET Junior Tube Cleaners you can clean tubes as small as .495" I.D. quickly and economically. Very little headroom is required for either vertical or horizontal tubes. Tube bundles can be cleaned without removal from shell.

The unusual power developed by the ROTOJET Motor is due to its simple design and exclusive Rotocentric (egg-shape) bore cylinder. A shaft and a blade are the only moving parts. Positive contact between blade and cylinder is always maintained. No leakage. No stalling at low speeds. Water-driven motors are also available.

Try ROTOJET Junior, and you will never go back to heavy, slow, external type cleaners costing many times more.

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and other
★ TUBULAR APPARATUS

532 ROTOJET Junior Air-driven Motor, universal joint, cone cutter.

C439 ROTOJET Junior Air-driven Motor, universal joint, drill head

C434 ROTOJET Junior Air-driven Motor, flexible coupling, expanding brush.

C324 ROTOJET Junior Water-driven Motor, univ. joint, pivot head

SEND FOR ROTOJET JUNIOR BULLETIN

ELLIOTT COMPANY-ROTO DIVISION
156 Sussex Avenue Newark 1, N. J.

tions, formerly the responsibility of T. L. Wheeler, vice president, who will retire shortly.

Philip Carey Mfg. Co.—Martin V. Coffey, formerly sales manager of the company's Miami-Cabinet Division, has been appointed general sales manager. Coffey joined the Miami-Cabinet Division in 1923 as a salesman and was made director of sales training for the organization in 1949.

F. H. McGraw & Co.—George R. Best has been appointed manager of the Pittsburgh office to succeed Francis J. Tytus who has resigned. In taking over his new post Mr. Best announced that the company's engineering department has been transferred from Pittsburgh to Hartford and that the Pittsburgh office will be an operational one. Ted Page will serve as Mr. Best's assistant.

G. R. Best

T. K. Hedinger

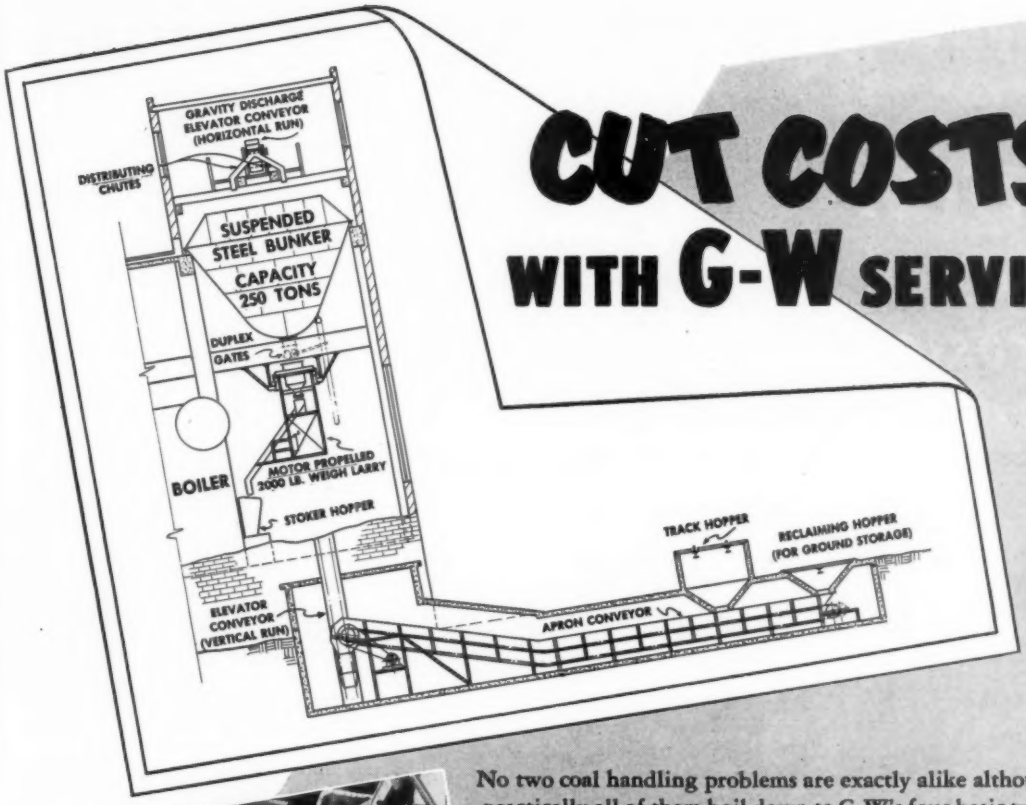
Palm & Paterson, Inc.—Election of T. King-Hedinger as vice president of the agency was announced recently by A. C. Palm, president. Mr. Hedinger has served as copy chief for the past two years.

The Imperial Brass Mfg. Co.—Frank McNellis, president of the company, died January 16th at the age of 69. Mr. McNellis was associated with his father, Charles McNellis, in the founding of the company in 1905 and became its president in 1914.

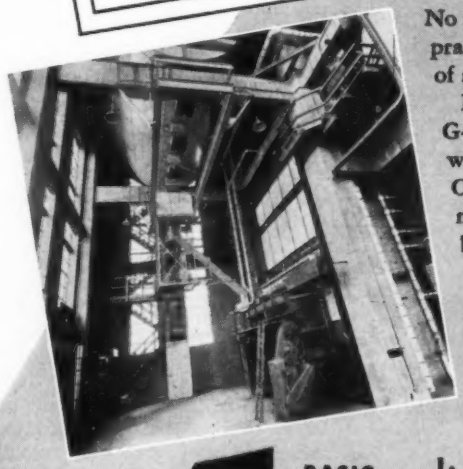
STOKER-VEYOR

A new type conveyor that moves coal from bin to one or more hoppers. Pictured is one being used in the Midland Bldg., Chicago, where its excellent performance has resulted in noticeable economy and cleanliness. Now, they report, they can hold a man on the job. Ask for Bulletin 916.

AMERICAN CONVEYOR CO.
1115 W. ADAMS ST. • CHICAGO 7, ILLINOIS



CUT COSTS WITH G-W SERVICE



No two coal handling problems are exactly alike although practically all of them boil down to G-W's four basic types of storage and handling.

For example, at a large U.S. Government arsenal, G-W designed and installed the suspended steel bunker with a gravity discharge bucket elevator shown at left. Coal is carried on the upper run of the conveyor, permitting free access to machinery and maximum bunker capacity. A cab-type weigh larry with recording beam provides clean, economical operation.

G-W conveyor system with capacity of 60 tons per hour. System consists of a Rail and Truck Hopper, a 30-inch Apron Conveyor, Gravity Discharge Elevator, 250-ton Suspended Steel Bunker and a 2000-lb. Weigh Larry.

4 BASIC WAYS TO CUT COAL HANDLING COSTS

No matter what your coal and ash handling problem is, from one of 4-basic types... Concrete Silos, Vitrified Tile Silos, Cylindrical Steel Tank, and Suspended Steel Bunker... G-W engineers can install the most efficient and economical storage and automatic handling system to fit your requirements of space, capacity and initial cost. Their recommendations to you, will be based on more than 140 years of design and engineering experience and on the performance records of hundreds of successful installations.

Fourteen interesting case histories, based on these 4 G-W basic designs, are described in Bulletin No. 300. Write for your copy, today.

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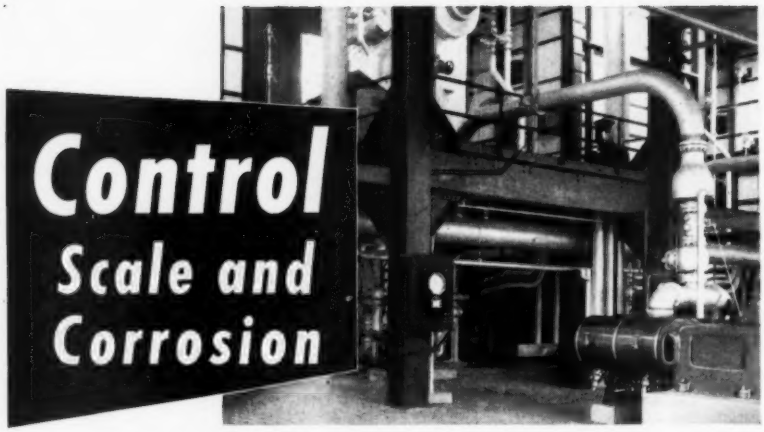

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Specializing in Water Conditioning

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Sole Distributor of Nelson Chemical Proportioning Pumps

NO SCORE **for centrifugals in any inning . . . when you pack with *PALMETTO PALCO®!***

On centrifugals pumping water or handling any neutral fluid to 275 F, there's no chance of scoring pump sleeves if the packing is Palmetto Palco.

Palco won't score because it can't score. Built of cotton roving, each strand is separately saturated with a Palmetto lubricant that provides a *self-lubricating* packing. Friction created is negligible.

Available in coil or ring . . . plaited square to required sizes. Write today for full particulars on this and the full line of Palmetto packings for all industry.

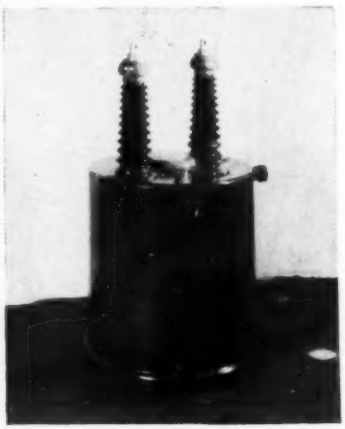
GREENE, TWEED & CO.
NORTH WALES, PENNSYLVANIA

Contact your fully-stocked Palmetto distributor on all packing problems . . . ask him about our special tools.

NEW EQUIPMENT AND DEVELOPMENTS

(Continued from page 14)

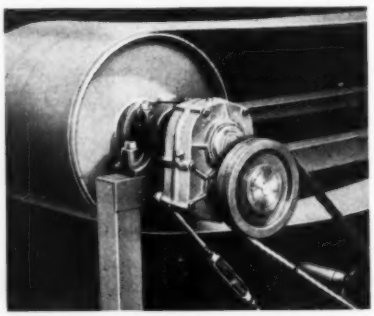
the transformer itself. Conduit connection to this junction box is carried under the top of the tank and through the side wall. Radio interference and corona are kept to low levels



by improved high-voltage bushings treated at critical points with a semiconducting glaze. Visual corona is eliminated up to 85 kilovolts by this method. Precipitation transformers are available in 5, 7½, 10, 15, and 25 kva sizes for 60,000 v or 75,000 v operation at 60 cyc. Other transformers in the same ratings are available for operation at 25 cyc.

319—PACKAGED SPEED REDUCER IS FLEXIBLE

A speed reducer, developed by the Dodge Manufacturing Corporation, embodies exclusive design features which make possible important installation savings. This packaged unit—designed primarily for conveyors,



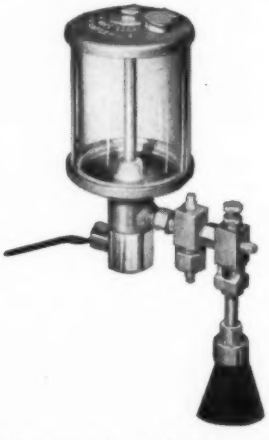
bucket elevators, agitators, mixers, feeders, processors, and similar machinery—consists of a reducer with a fixed ratio of 15 to 1, driven by a motor through any V-belt or flat belt

drive. Any desired output speed from 13 to 133 rpm can be obtained through stock sheaves. Principal component part is the heat treated and shaved double train of helical steel gears. These gears are securely held to the shaft, on both sides of the unit, by steel locking collars. A bushing keyed into the sleeve adapts the sleeve to any desired shaft size. The light weight of the unit is emphasized by this fact—size No. 1 weighs only 35 lb. A torque arm anchors the reducer and provides quick, easy adjustment of the belt tension by means of a turn buckle. No sliding motor base, foundation, or flexible coupling is required. A backstop that prevents reversal of the load is available, which is easily installed on the input shaft. This accessory is sealed from dust and dirt by a carefully machined cast iron housing. The desired speed and size of driven shaft are the only data required to select the reducer. Different output speeds can be attained by changing either sheave in the drive. The reducer is easily shifted from one machine to another, and, if a different size shaft is involved, only an inexpensive bushing is required. Six sizes with capacities up to 28.5 hp are available.

For more information use one of the convenient reply cards on page 37. No postage necessary. Circle the key numbers of items about which you want additional information.

320—SOLENOID OPERATED OILER FOR CHAIN LUBRICATION

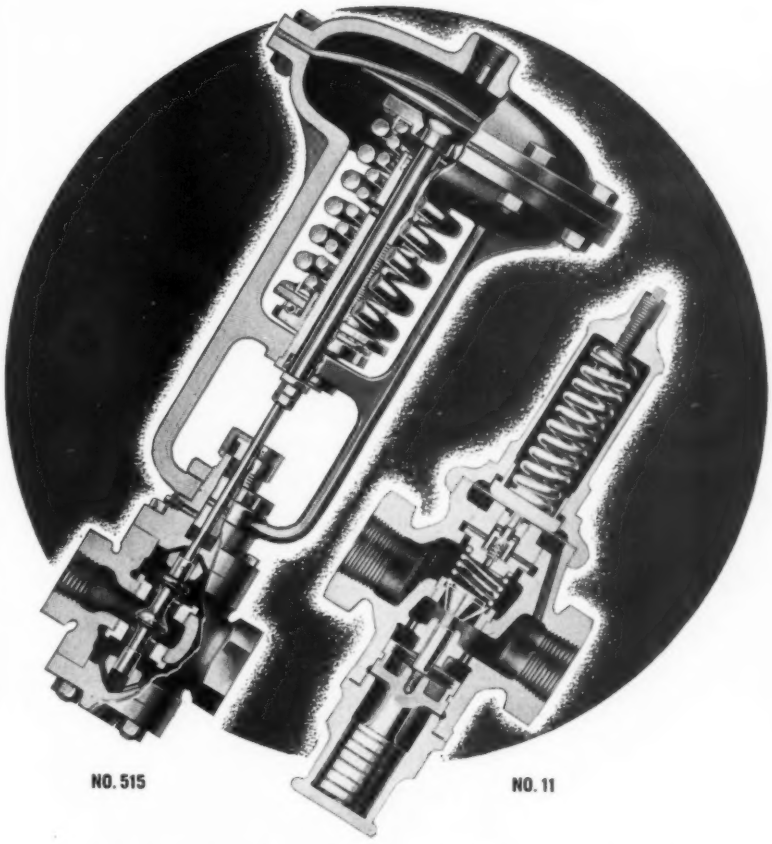
Solenoid operated oiler assures positive lubrication whenever the chain is running, and it eliminates the need for applying lubricant by hand. It avoids excess lubricant, keeps floors clean, and



lengthens the life of the chain at little cost. New oiler feeds lubricant to chains by gravity from a reservoir through a solenoid operated valve, to a brush which rides the chain, spreading and wiping the desired amount of oil even-

FOR PREFERRED PERFORMANCE *without*

Paying Premium Prices . . . Use Masoneilan Pressure Regulators



You can depend on Masoneilan performance-proved reducing valves and pump pressure regulators to provide accurate control of steam pressures. Constructed of quality materials throughout, these regulators incorporate many cost-cutting features that assure long operating life with little if any maintenance.

No. 11—Initial pressures up to 250 lbs. reduced to any desired pressure between 5 and 75 lbs. or 75 and 225 lbs. Sizes ½″ to 2″ — bronze; 2½″ to 4″ — iron.

500 Series — Maximum working pressures from 125 lbs. at 350°F, to 250 lbs. at 450°F; pressure ranges ¾-3; 2-8; 6-25; 20-75; 60-160 lbs. Sizes ½″ to 6″.

MASON-NEILAN REGULATOR CO.

1191 ADAMS STREET, BOSTON 24, MASS., U. S. A.

Sales Offices or Distributors in the Following Cities:

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now ready

new ideal..

Bulletin No. 68

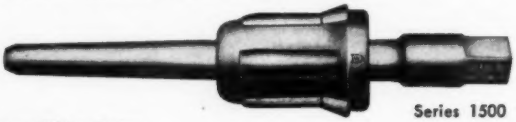
Developed in condensed, easy-to-read form, with Specification tables for selecting the *Correct Tube Expander* to meet your particular need.

Series 900

Ideal Rolling and Flaring Tube Expanders

The *new* 900 series for Superheater and Small Tubes.

Also improved 1500 series and Operating Accessories.



Series 1500

See Your Dealer, or Write Today.
Ask for BULLETIN 68.

The Gustav **Wiedeke** *Company*
DAYTON 1, OHIO

CHANGE BACK PRESSURE QUICKLY AND EASILY

wit

COCHRANE

MULTIPORT RELIEF VALVE

1. Easily adjustable to any set pressure.
2. Gradual opening and reseating of discs, which means pressure increases relieved smoothly with minimum relief area exposed, making for economy of operation.
3. No blow back in reseating.
4. Equilibrium of system is not disturbed.
5. Complete protection of equipment is assured.

Write for Publication 4150

COCHRANE CORPORATION
3108 North 17th Street, Phila. 32, Pa.
In Canada:
Canadian General Electric Co., Ltd., Toronto

ly on the chain. The solenoid valve can be wired across the line of the driving motor and will turn on the oiler only when the chain runs. Drop feeding of lubricant through sight feed valves to brushes is adjustable. Reservoirs for Chain Oilers are available in six sizes ranging from 9 ounce to 1 gallon in unbreakable lucite or glass for temperatures above 160° F. Aluminum alloy bodies make the oilers light in weight. Oil-Rite Corporation.

For more information use one of the convenient reply cards on page 37. No postage necessary. Circle the key numbers of items about which you want additional information.

321—FLOOR MARKER CAN BE OPERATED WITH ONE HAND

Designed for easy, low cost operation is a new line marker that makes straight, curved, continuous, or skip lines or lettering. Visible paint flow eliminates waste of paint. The marker is made of welded steel, is sturdy, long-lasting, and has no moving parts to get out of order, light in weight, and is easily portable. Lines

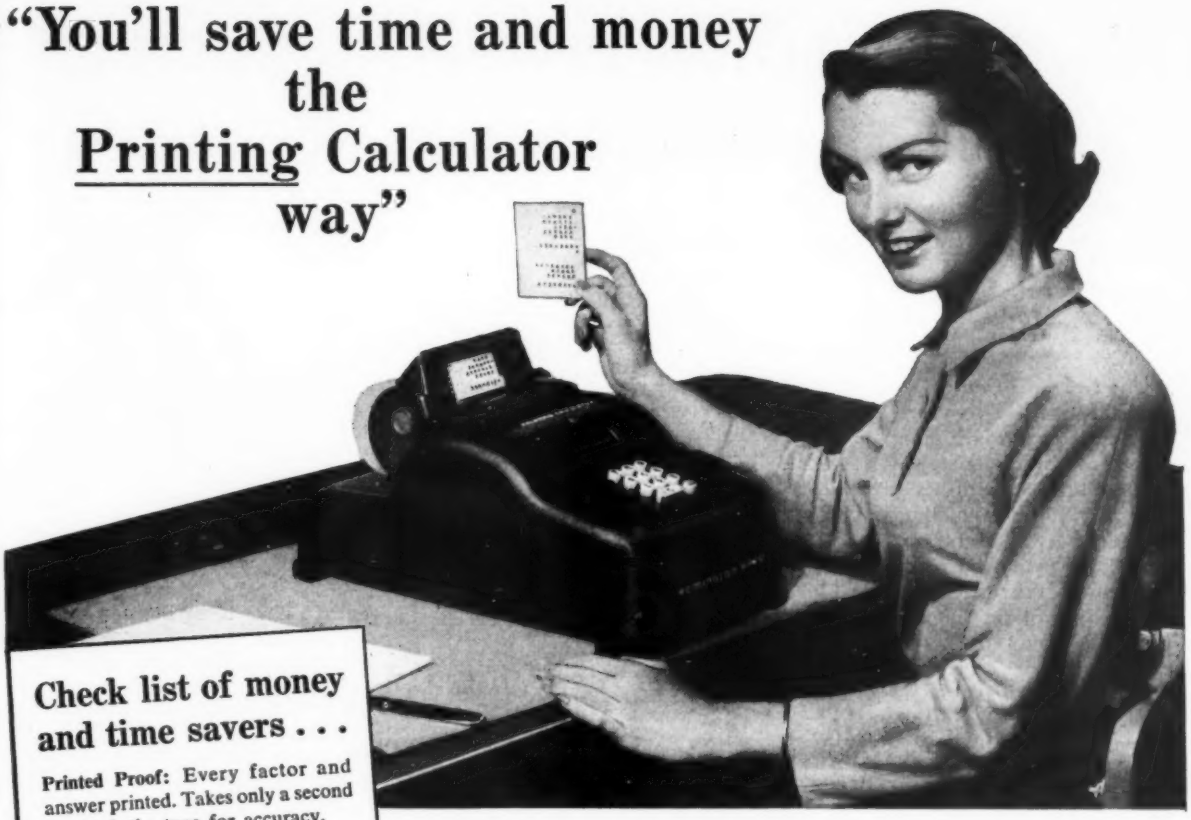
painted are approximately 3⅞ in. wide, using any good traffic or line marking paint. Unit is quickly cleaned by flushing with gasoline or paint thinner. Lasting Products Company.

322—STOP VALVES SIMPLIFY AND REDUCE MAINTENANCE

Forged steel stop valves built by Edward Valves, Inc., can be successfully installed in almost any service where small steel globe or angle valves are used. These all-purpose valves were designed to fill the need for steel stop valves with wide applicability, good service characteristics, ease of repacking, and a reduced pressure loss. Swing

(Continued on page 144)

"You'll save time and money the Printing Calculator way"



Check list of money and time savers . . .

Printed Proof: Every factor and answer printed. Takes only a second to check the tape for accuracy.

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Electrified Multiplication: Single-action multiplication is faster, easy, foolproof.

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Soundproofed and Electrified: Steel cushions keep high-speed motor vibration muted. It's quick, quiet—with printed proof for accuracy.

There's no place for waste in industrial figure work, and with the new Remington Rand Printing Calculator you eliminate re-runs for accuracy and manual copying from hard-to-read dials. Extra motions are gone because every problem is automatically calculated—every factor, and every answer is automatically printed on the tape. And, the tape is your proof of accuracy, your *printed*, permanent record . . . on file for future use.

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See how you can save through greater figure efficiency . . . send the coupon below to Remington Rand, New York 10.

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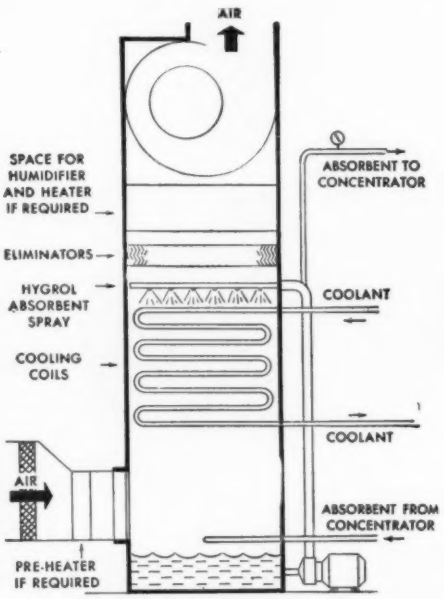
IP-3

(Advertisement)

New Method Gives Precise Control in Air Conditioning

Niagara "Controlled Humidity Method" Uses Hygrol, Hygienic Liquid Absorbent

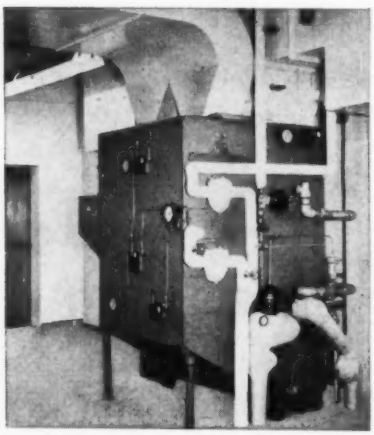
● The Niagara "Controlled Humidity Method" is a new system of air conditioning giving complete control of temperature and relative humidity, holding constant conditions or varying them at the will of the user. Especially, it provides dry air at normal atmospheric temperatures with little or no refrigeration required. A condition of 15 grains of moisture per pound of air at 85 deg. F. dry bulb temperature has been produced without refrigeration.



NIAGARA CONTROLLED HUMIDITY METHOD — FLOW DIAGRAM

The apparatus is enclosed in a casing thru which the air is drawn by fans. The air is filtered and then enters a chamber where it is dehumidified in passing thru a spray of "Hygrol" Liquid (a hygienic hygroscopic chemical that absorbs the air-borne moisture and contains no salts or solids to precipitate). In the same chamber are located cooling coils which remove the latent heat of evaporation and also sensible heat as required.

The absorbent liquid spray falls into a tank at the base, where it is piped to a concentrator, removing moisture taken from the air. The re-concentrated liquid returns to the system. This process is continuous, and the apparatus operates at full capacity at all times.



The same equipment may be used to provide winter air conditioning when required, by installing a tempering coil at the outdoor intake, an humidifier, and a reheat coil above the eliminators.

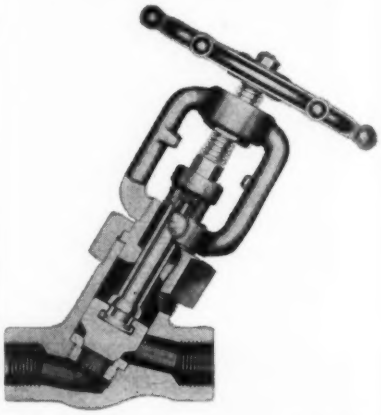
This equipment is manufactured in a range of sizes providing from 1000 to 20,000 CFM of conditioned air from a single unit, and mutiple unit installations are practical. It is expected that, by reducing the need for refrigeration, the cost of air conditioning will be reduced by this method. Applications generally are in a temperature range from 35 deg. F. upward. Below the freezing temperature of water, the Niagara "No-Frost" method is applicable.

The equipment is protected by U. S. and foreign patents. Installations have been made in food and chemical process industries, in packaging hygroscopic products, for preventing condensation of moisture on metals and other products in storage, in air conditioning for laboratory control and for human comfort.

For further information, write Niagara Blower Company, Dept. **IP,** 405 Lexington Ave., New York 17, N. Y.

(Continued from page 142)

bolted packing glands and large packing chambers make any necessary repacking extremely simple. Interchangeability of parts greatly reduces maintenance inventories. Bronze yoke bushings prevent galling or freezing of stem. Valves are constructed of drop forged steel for greater strength and are available with bolted or union bonnets in sizes ¼ in. through 2 in., with screwed or socket welding ends. Two ranges of service are available: 600 psi at 900° F and 1500 psi at 850° F for steam, oil, and gas service.



For more information use one of the convenient reply cards on page 37. No postage necessary. Circle the key numbers of items about which you want additional information.

323—SOUND PROOF BOOTH FOR FACTORY INTERCOM

Practical and economical solution for acoustic problems is offered in a new sound booth that can be installed in high noise level areas. By placing the intercommunication station in the sound-proofed booth, a high percentage of the background shop noises are effectively absorbed and not transmitted in the form of a disturbing blast to the station in the quiet area. Two-way conversation between a quiet location and a noisy location can be carried on clearly and intelligibly. This unit manu-

factured by Executone, Inc. can also be utilized effectively in conjunction with dictating machines, sound system microphones, and other makes of intercommunication systems. Of wooden construction, in attractive dark brown finish, the booth is lined with acoustic insulation board and is 13½ in. high, 13½ in. wide, and 13½ in. deep, outside dimensions.

324—DEVELOP POWER SOCKET WRENCH SETS

To help meet the growing demand for high-strength power impact socket wrenches, three new sets have been added to the line of the Plomb Tool Company. One set is designed for use with various makes of impact tools and

wrenches and provides six basic ½ in. drive socket wrenches with single hexagon openings of 7/16, ½, 9/16, ⅝, 11/16, and ¾ in. Another set also has six ½ in. drive socket wrenches, but the openings range from 9/16 to ⅞ by 1/16 in. steps. The third set includes from three to six each of the sockets in the other two sets, along with a universal joint, adapter, stud puller, and four special sockets.

325—SAFETY CUT-OUT SHUTS OFF OVERLOADED MOTOR

An improved anchor overload safety cut-out for all types of conveyor systems has just been announced by Anchor Steel and Conveyor Company. The function of the cut-outs is to shut off the electric motor instantly when conveyor or machine is overloaded, and re-set automatically, ready for immediate operation. The new cut-out will handle capacities from 20 to 150 in./lb. Features include compact, streamlined design, dust tight and drip

A complete, compact water heater embodying distinctive and dependable safety features.

Simplified inexpensive installation requires only attachment of water and steam pipes. No accessories to buy.

Utilizing high pressure steam it consistently delivers water at a SAFE temperature of 120° F. for ideal washroom use with no danger of scalding. A slight change makes possible the delivery of a secondary supply of water at 160° F. to 180° F.

The COE Northwestern Safety Water Heater operates with maximum thermal efficiency and affords long service life through a minimum of corrosion. Completely insulated, it is equipped with a glass lined A.S.M.E. tank. Pressure gauges afford visual operation checking. Seventeen sizes of heaters available with capacities from 200 to 3000 G.P.H.

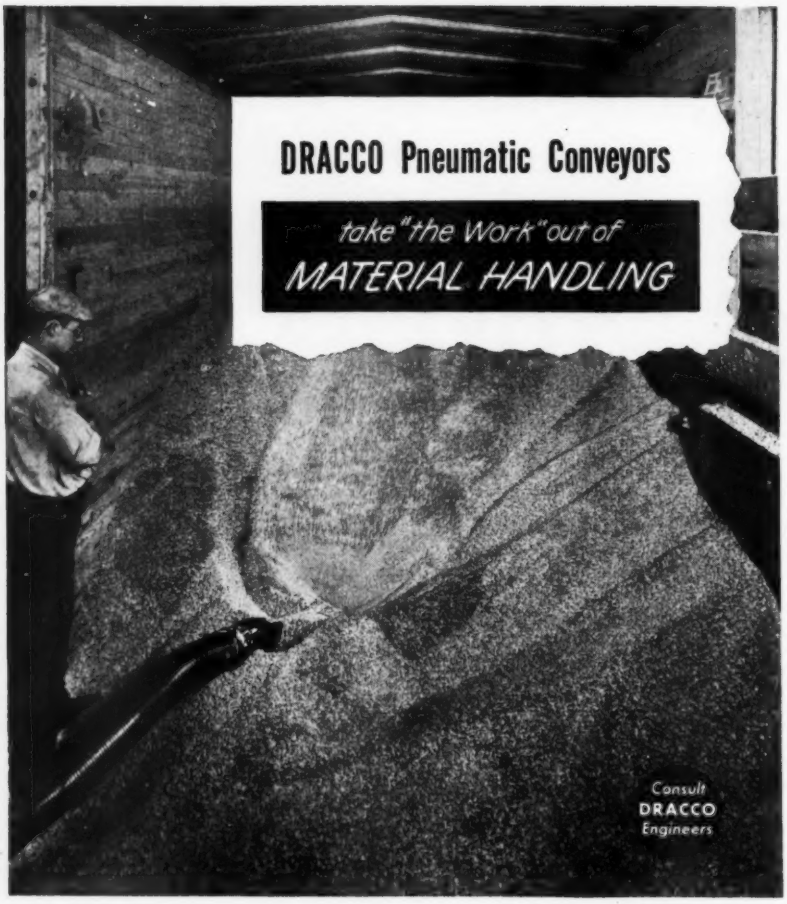
It's POSITIVELY SAFE because:

1. A TEMPERATURE REGULATOR immediately transmits temperature changes to a control valve, minimizing lag and overshooting of water temperature.
2. A TEMPERING VALVE prevents delivered water from rising to a scalding temperature.
3. A PRESSURE RELIEF VALVE opens when safety point is exceeded, preventing fracture of tank.
4. A TEMPERATURE RELIEF VALVE discharges water to open sewer, should temperature exceed 212° F.

Your Copy of the WATER HEATER Bulletin will be mailed promptly upon request.

THE COE MANUFACTURING COMPANY

502 BANK ST., PAINESVILLE, OHIO



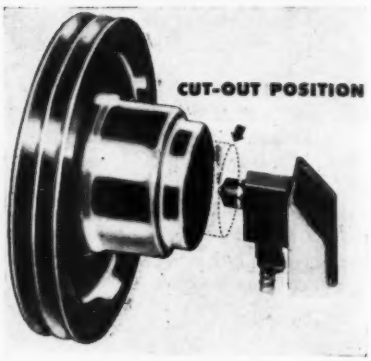
The main reason DRACCO Pneumatic Conveyors are economical is because they take "the work" out of moving chemicals, grains and granular materials. This naturally reduces labor costs and results in substantial savings. There are also other savings, materials may be purchased in bulk at lower cost, dust hazards are eliminated, materials are not contaminated. DRACCO Pneumatic Conveyors are saving money for many. Why not have DRACCO Engineers check your handling operation? They have over 35 years' experience reducing handling costs. Perhaps they can save you money.

For Further Information Write

DRACCO CORPORATION

4046 E. 116th St., Cleveland 5, Ohio New York Office: 150 W. 42nd St.

DUST CONTROL EQUIPMENT
PNEUMATIC CONVEYORS • METAL FABRICATION



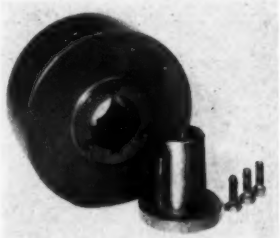
proof case, and lubrication for life, requiring practically no maintenance. Permits application in atmospheres containing water, oil, and acid, and may be installed outdoors.

For more information use one of the convenient reply cards on page 37. No postage necessary. Circle the key numbers of items about which you want additional information.

326—CLUTCH COUPLING IS ADJUSTABLE ON JOB

Designed to accommodate any shaft from ¾ to 1¾ in. dia (in 1/16 in. increments) with standard keys a new clutch coupling with taper bushings is adjustable right on the job for

MOTOR HALF



DRIVEN HALF

various hp requirements. The coupling consists of two sections—a motor half and a driven half. The split taper bushing wedges the tapered coupling hub tightly to the shaft, always assuring a perfect fit to the shaft. These are complete packaged units ready for use with motors from .43 hp at 580 rpm to 25.7 hp at 1800 rpm. This flexible coupling couples, cush-

ions, limits the load and acts as a clutch, and can be used wherever a coupling is required to improve a motor drive. Centric Clutch Co.

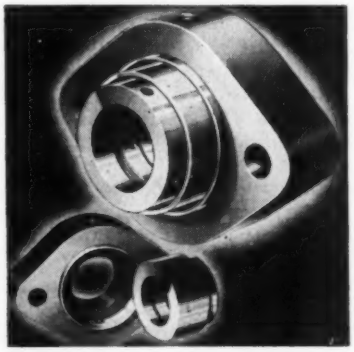
327—STARTER UNITS CONTROL GROUPS OF MACHINES

Standardized control centers containing motor starter units for the centralized control of groups of machines are available. These starter units feature plug-in type disconnects on the line side. All starter units are 20 in. wide by 20 in. deep, with heights in multiples of 14 in. for in-

terchangeability in standard indoor structures either 76 or 90⅜ in. high. Starter units can be mounted back-to-back in these same structures for the most efficient utilization of available space. Starter units can be locked in a positive tilt-out position, disconnected from the line. New self-connecting Magna-Grip bus connectors automatically connect the line terminals when the starters are inserted. Guided insertion assures proper seating of the bus connectors. Westinghouse Electric Corp.

328—HIGH PRESSURE SEAL REDUCES FACE WEAR

An improved high pressure seal, designed to meet the sealing require-



ments of equipment handling hydrocarbons under high pressures and

DURA PLASTIC Packings

AN OUTSTANDING SEMI-METALLIC PACKING for stuffing box service on pumps, valves, mixers and the like handling gasoline—water—air—steam—oils—and chemicals.
PLIABLE . . . RESILIENT . . . UNIFORM IN DENSITY

Write Today
For File No. DPIP covering Dura-metallic and Dura Plastic Packings.

The PERFECT SEAL

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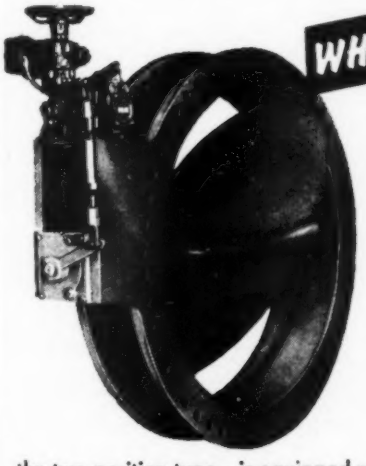
KALAMAZOO MICHIGAN

MANUFACTURERS OF METALLIC and SEMI-METALLIC PACKINGS
ROTARY MECHANICAL SEALS and PACKING TOOLS



WHERE CAN YOU USE IT?

This ROCKWELL Automatic Butterfly VALVE

Another in the series of industrial process valve applications that indicate their great service versatility. It is a 60", 125 lb. drilling, flanged butterfly valve complete with control motor having a torque of 300 ft. lbs.

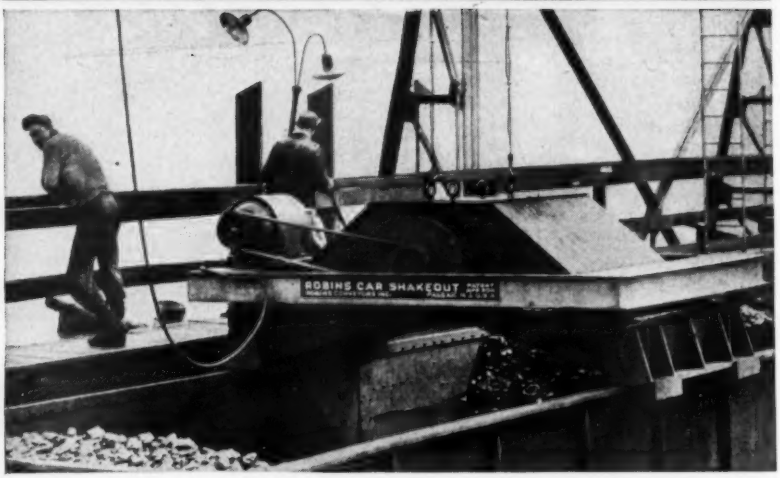
The blade, designed for maximum 15 lbs. air pressure, is fitted with thru shaft and needle bearings. The controller—of the two position type—is equipped with indicating instrument and reversing contacts for observing blade position. It may be manually adjusted.

Whether for controlling air or gases at high or low temperature or pressures, process fluids or granular solids, there's a Rockwell slide or butterfly valve of any metal, any size, with any desired control mechanism to meet your specific needs. Get our catalog.

ROCKWELL VALVES FOR AIR • GAS • LIQUIDS • SOLIDS

W. S. ROCKWELL COMPANY, 230 Eliot St., Fairfield, Conn.

PROVEN PERFORMANCE!



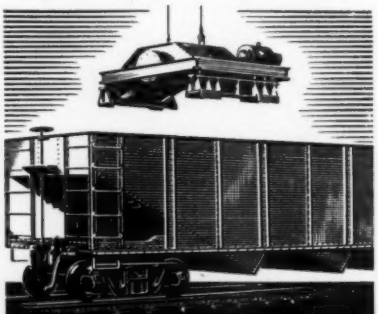
"PUSH-BUTTON" UNLOADING SAVES TIME, MONEY AND LABOR FOR OVER 500 USERS

Just push a button . . . and the intense vibration generated by the Hewitt-Robins Car Shakeout does the rest. It unloads 50 and 70 ton cars in as little as 90 seconds. It unloads them no matter how tightly the load is packed.

Continuous field operation by over 500 users proves that the Hewitt-Robins Car Shakeout is actually *twelve times faster* than manual unloading. And because it empties hopper cars "broom clean," no material is left in the car. One user reports that he saves a full car of coal out of every 200 unloaded!

The Hewitt-Robins Car Shakeout practically eliminates demurrage charges. It cuts the unloading crew from five or six to two—even one. It ends damage to cars, danger to workmen . . . makes a tedious, expensive operation quick, simple and safe.

Hewitt-Robins originated the Car Shakeout; Hewitt-Robins has by far the greatest backlog of experience in vibrating car unloaders. Two models are available—Model GS for general service, where car receipts are 15 cars a day or less, and Model HD for continuous, heavy duty, high speed unloading. A note on your company letterhead to Robins Conveyors Division, Passaic, N. J., will bring full particulars about this better, *proven* way to unload hopper cars.



HEWITT-ROBINS CAR SHAKEOUT

HEWITT-ROBINS HR **INCORPORATED**

BELT CONVEYORS (*belting and machinery*) • BELT AND BUCKET ELEVATORS
CAR SHAKEOUTS • DEWATERIZERS • FEEDERS • FOAM RUBBER PRODUCTS
FOUNDRY SHAKEOUTS • INDUSTRIAL HOSE • MINE CONVEYORS • MOLDED RUBBER GOODS
RUBBERLOKT ROTARY WIRE BRUSHES • SCREEN CLOTH • SKIP HOISTS • STACKERS
TRANSMISSION BELTING • VIBRATING CONVEYORS, FEEDERS AND SCREENS

temperatures incorporates three major improvements. First, improved control and balance of hydraulic pressures to eliminate the problem of excessive sealing face wear. Second, a reduction in the number of parts susceptible to wear and deterioration which minimizes operation and maintenance. Third, a simplified cooling method eliminates the need for auxiliary cooling systems. The seals are designed to handle a variety of liquids at pressures up to 600 psi and temperatures up to 250° F in centrifugal pumps and other equipment handling crude oils, gasoline, and propanes. Felt Products Mfg. Co.

For more information use one of the convenient reply cards on page 37. No postage necessary. Circle the key numbers of items about which you want additional information.

329—NON-SKID FLOOR PLATE PREVENTS ACCIDENTS

Especially effective when used for industrial floors, loading platforms and ramps, walkways, building entrances, and for trench and hatch covers a new

abrasive rolled steel floor plate has been released by the Alan Wood Steel Company. There is no slipping even when the plate is placed on a steep incline and it never loses its non-slip characteristic because as the surface wears new abrasive particles are constantly exposed. Abrasive grain, the same type used in grinding wheels, is rolled as an integral part of the upper portion of steel floor plate. It can be sheared, drilled, counter-sunk, machined, and flame-cut. These floor plates are available in thickness from $\frac{1}{8}$ to $\frac{3}{8}$ in. inclusive, and in widths up to 60 in. maximum by 144 in. long.

NEW BULLETINS

(Continued from page 16)

To obtain any of these free booklets circle the corresponding letter on one of the convenient post cards on page 37.

of explosion-proof motors. Particular emphasis is placed on motor application in such locations where hazardous conditions exist. Motor construction details are provided that illustrate the corrosion-resistance protection. Reference is also made to explosion-proof gear-motors in single, double, and triple reductions. Reliance Electric & Engineering Company.

A-c Regulators (R) Factual ten page bulletin covers numerous basic circuit voltage regulators that are accurate and economical to operate. Design features and performances are given along with specifications of each unit. Sorensen and Company, Inc.

Electric Conduits (S) New 30-page catalog describes and illustrates many types of electrical conduits. First half of the booklet is devoted to rigid steel conduits, elbows, nipples, bondnuts, locknuts, bushings, and insulated bushings. A comprehensive review tells how the steel is fabricated and how it is zinc-treated against corrosion. Flexible steel conduit for branch circuit wiring is available in sizes from 5/16 to 3 in. National Electric Products Corp.

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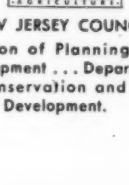

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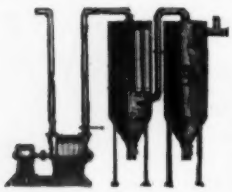

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Small Motor Selection (T) Four page booklet explains why there are different types of fractional horsepower motors, and the factors to be considered in selecting the right motor for the application. A tabular form presents the various types of small motors, complete data concerning hp range, speed characteristics, torque, reversibility, bearings, mountings, and application. Typical speed-torque curves for fractional hp motors are included. Westinghouse Electric Corporation.

Synchronous Motors (U) Two-color eight-page bulletin covers high-speed synchronous motors for applications such as, driving pumps, grinders, compressors, saws, beaters, fans, generators, conveyors, and mixers. The bulletin contains three typical installation stories, and discusses construction features, mechanical modifications, and direct-connected exciters for the motors. Motor ratings are from 20 to 1500 hp at 60 cycle speeds of 1800 rpm. General Electric Co.

D-c Rectifier Substation (V) Rectifier unit substations, that provide a source of d-c power installed near the load, are described in a 16-page booklet. Component parts of the rectifier substations are explained along with dry-type transformers. The unit can be mounted anywhere in a factory space with no fire or explosion hazard. Metal-enclosed switchgear for both a-c and d-c portions of the substation are shown. Westinghouse Electric Corp.

Safety Switches (W) Latest information on high capacity interrupter safety switches is contained in a new folder, just released. Arc-quenching action, a new grid pin design which breaks up the arc and thus interrupts heavy loads quickly and cleanly is illustrated by several schematic drawings. Other features described include center-front operation, front fusing, and roller-cam action which throws the switch to full OFF and ON with no possibility of dead-centering. The Trumbull Electric Manufacturing Co.

Small Transformers (X) Literature in a new 28-page bulletin describes the core and coil unit, no-load tap changer, tank construction, cooling methods, oil preserving systems, bushings, terminal compartments, indicators and testing of single phase transformers, 69,000 volts and below—up to 5,000 kva inclusive, and three-phase transformers, 69,000 volts and below—up to 15,000 kva inclusive. Also included is a table of preferred voltage ratings for step-down power transformers and photos of typical installations. Allis-Chalmers Manufacturing Co.

D-C Generators (Y) Technical treatise contained in a recently issued bulletin describes the construction of d-c generators 150 kw or larger. Also included is a description of the "Frog-Leg" armature winding, a development of this company. The bulletin is well illustrated. Allis-Chalmers Manufacturing Company.

INSTRUMENTS, CONTROLS, RECORDERS

Combustion Safeguard (Z) An explanatory bulletin on a new combustion safeguard for oil and gas fired furnaces, ovens, boilers, kilns, and other

heating equipment, has just been released. The new series incorporates many economy and safety features. Described and illustrated. Wheelco Instruments Company.

Time Cycle Controllers (AA) New 16-page bulletin on time cycle controllers has just been released. The bulletin features an instrument which is particularly adaptable to those applications that have a multiplicity of functions to perform during the course of a cycle. A whole new family of time cycle controllers is presented. These controllers are available in five different models for applications requiring all-electrical or all-pneumatic, or any specified combinations of each. The bulletin shows how they control any particular group of functions which may be required in the sequence of a manufacturing operation according to a predetermined schedule and over a specifically timed period. Taylor Instrument Companies.

Oxygen Analyzers (BB) Two attractive bulletins, which have just been released, cover the highly important and timely development of oxygen recorders and analyzers. Theory and principles of operation of newly announced equipment are completely explained, and numerous applications are given. Specifications are supplied for each of the analyzers and auxiliary equipment. Arnold O. Beckman, Inc.

Ring-Balance Flow Meter (CC) Illustrated bulletin explains how automatic compensation for pressure or temperature variations, or for both, are achieved in flow measurement of gases, liquids, and other fluids. Schematic diagrams show how a corrected record is automatically and continuously produced, and how pressure and temperature are compensated. Hagan Corp.

Level Meter (DD) New 24-page bulletin describes magnetic tape-and-drum, electronically transmitting, ball-float, pneumatic, and differential pressure units; V-notch weir and Parshall flume flowmeter instruments; and chemical service sight gage glasses. Detail views are shown for numerous instrument features with accompanying explanations. Fischer & Porter Company.

To obtain copies of any of these recently published bulletins for your files use one of the convenient postcards on page 37.

MATERIAL HANDLING

New Equipment (EE) Recently available lift trucks, cranes, tractors, and other materials handling equipment are described in a new 8-page illustrated folder. A. & A. Machinery Corporation.

Palletless System (FF) New 4-page illustrated bulletin describes a fork truck system of palletless handling. Pictures and drawings illustrate application of the system to transporting and tiering of loads of sacks, cartons, bails, and drums. Elements of the system are presented in an overall inclusive manner that permits application of the system to special requirements of specific industries. Yale & Towne Manufacturing Company.

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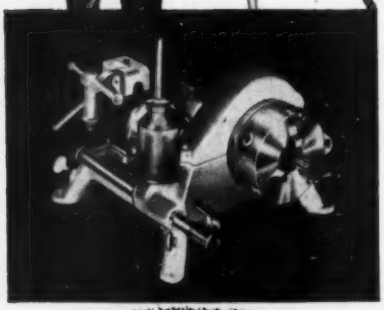

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Sectional Conveyor (GG) New bulletin gives an illustrated description of a recently introduced sectional conveyor. This unit, easily assembled in the field, consists of a head (drive) section, a tail section and any desired number of intermediate truss sections to form a conveyor of any length up to limitations of the belt. Two types of takeups are available: protected screw type for conveyors up to 200 ft long, vertical gravity type for longer installations. Robins Conveyors Div., Hewitt-Robins, Inc.

Handling Methods (HH) Modern methods, which brought about substantial savings in handling materials for one specific company, are discussed in detail in a new bulletin. On-the-job photographs illustrate the various problems overcome to improve handling efficiencies. Towmotor Corporation.

Lift Trucks (II) Action photographs and description of a new 2000 lb capacity lift truck are covered in an eight page bulletin. Numerous features are illustrated and explained such as: cooler operating temperature; larger, long-life clutch; double-acting hydraulic tilt control; better braking power; increased speed; and larger gasoline tank. Specifications are included. Hyster Co.

Material Handling (JJ) Illustrated new 20 page booklet describes briefly the material handling and power transmission equipment employed in the grain and allied fields. Information covers: box car unloaders; car spotters; screw conveyors; bucket elevators; drives, both gear and chain; clutches; and couplings. Link-Belt Company.

Fork Trucks (KK) Attractive catalog just released covers the full line of this company's fork-lift trucks and towing tractors. Photographs of each size and style of truck are shown, with accompanying specifications. Various attachments such as cranes, rams, shovels, and rotating forks are illustrated. Clark Equipment Co., Industrial Truck Div.

POWER TRANSMISSION

Diesel Converters (LL) Multi-color 24-page bulletin covers the inside story of a torque converter, and how it can be adapted to this company's industrial Diesel engines. Numerous applications are covered, such as cranes, tractors, locomotives, petroleum industry, and stationary engines. Performance curves are included. Detroit Diesel Engine Division, General Motors Corporation.

Roller Chain Assembly (MM) Roller chain assembly consisting of standard riveted roller chain with a special single pin connector link is described in a new bulletin. The equipment is assembled at the two foot mark and at the end of each basic five foot length in which this chain is assembled. This new connector pin and other important features are fully explained in the new bulletin. In addition to regular five foot basic length sections, the assembly is supplied in standard short sections of two, six, and ten pitch units. Tables and examples are provided showing suggested combinations of these units for various length drives. Included are construction diagrams, illustrations,

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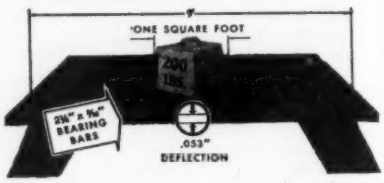

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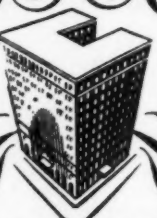

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specifications, and dimensions. Baldwin-Duckworth, Div. of Chain Belt Co.

Roller Chains (NN) Four available types of double pitch roller chains adaptable for drive and conveyor service are illustrated and discussed in a new bulletin. Dimension tables, price list, and recommended maximum working loads are included to aid in proper selection of all types of chains. Baldwin-Duckworth, Div. of Chain Belt Co.

Gear Coupling (OO) Construction details of a gear coupling are illustrated and explained in a recently published bulletin. Dimensional data for couplings ranging in size from ¾ to 6 in. bore are included. Capacities, listed per 100 rpm, range from 4 hp for the smallest bore to 550 hp for the 6 in. bore. Sier-Bath Gear & Pump Co., Inc.

Cast Sprockets (PP) Dimensions, specifications, list prices, sprocket style, and all other necessary information are included in a bulletin just released. Of particular importance are the rules for selection, alignment, care of sprockets, and complete data on what should be considered when ordering sprockets. Chain Belt Company.

Roller Chain Application (QQ) Material for a new 24 page bulletin, which covers roller chain applications, was assembled with the help and cooperation of roller chain designers throughout the country. Each application is described and illustrated both with photos and simplified working drawings. Innumerable field applications are shown for light and heavy duty work. Baldwin-Duckworth, Division of Chain Belt Company.

To obtain copies of any of these recently published bulletins for your files use one of the convenient postcards on page 37.

PUMPS AND ACCESSORIES

Direct Flow Pump (RR) Six page data sheet gives information on new direct flow pump. Includes information on construction and design, specifications, dimensional drawings, and illustrations. Aldrich Pump Company.

Centrifugal and Piston Pumps (SS) Descriptive data covering numerous types of pumps, together with applications and general information are included in a new 24-page catalog. Condenser Service and Engineering Company, Inc.

Sewage and Trash Pump (TT) Recently developed bladeless sewage and trash pump is described and illustrated in new 16-page bulletin. Information covers design, construction, and operation. Fairbanks, Morse and Company.

TOOLS AND SPECIALTIES

Lock Nuts (UU) Information on lock nuts has been assembled in a new illustrated folder that includes two interesting case histories and suggestions for various applications. The Palnut Company.

Wagon Drills (VV) An interestingly illustrated 10-page bulletin describes three models of wagon drills in detail and includes pertinent testimony of applications. Worthington Pump and Machinery Corporation.

Portable Power Unit (WW) Just released bulletin contains information on the four features listed for this company's portable power unit. Various case histories bring out the fact that the unit can be employed for such operations as pipe threading, pipe cutting, and windlass for pulling cable. Price list for several kits is included. Beaver Pipe Tools, Inc.

VALVES, PIPING, AND FITTINGS

Valves (XX) New bulletin describing globe and angle stop valves has just been issued. The bulletin gives design details, dimensional data, and material specifications for new forged steel valve series built in both 600 and 1500 psi classes. Valves are of drop forged steel construction and can be had with either bolted or union bonnets and with either screwed or socket welding ends. Edward Valves, Inc.

Valve Specialties (YY) Newly printed general binder contains many bulletins that cover pressure, flow, and liquid level controls for steam, gas, air, water, oil, and other fluids. Price list, dimension data, and specifications are shown for each type of valve for both light and heavy duty service. Davis Regulator Company.

HEATING, VENTILATING AND AIR CONDITIONING

Corrosion Resisting Fans (ZZ) New bulletin shows new drive construction for larger fan sizes. Contains general information on alloys, standard constructions, and applications. Also details of important types and accessories with advice on selection of right fan size. The Duriron Company, Inc.

Dust Collectors (AAA) Rapid Selection of correct size unit type dust collectors for any industrial dust problem requiring from 200 cfm to 3,600 cfm is given in a new bulletin. Among tabulated comparison of units are general recommendations of typical wheel sizes that any single unit will handle. Also given is an exact method for determining the correct amount of air suction required at any wheel in accordance with New York State Code requirements. Aget-Detroit Company.

Humidity Control (BBB) Recently published pamphlet illustrates and discusses a controlled humidity method to obtain dry air without mechanical refrigeration. A four color diagram shows the step-by-step process in which the air is dehumidified by absorption. Niagara Blower Company.

MISCELLANEOUS

Dust Control (CCC) Three new folders describe economical control of coal dust, foundry dust, and dust in industrial plants. Cause, effect, and treatment are described. Aquadyne Corp.

Safety Equipment (DDD) 1950 catalog of personal protective equipment and industrial safety devices, has just been released. Catalog covers respiratory devices, eye protection, carboy pumps, drum pumps, miscellaneous industrial safety equipment for use in industries, mines, and utilities. General Scientific Equipment Company.

The New 1950

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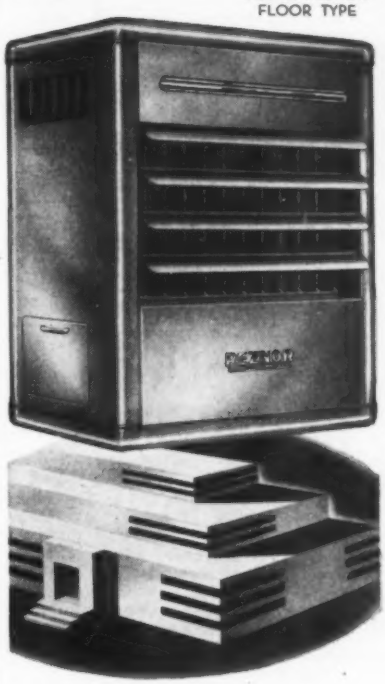

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READERS' GUIDE

(Continued from page 26)

83—See page 29. Copper Tubes: Copper is the answer to any industrial application where rust is taboo. Anaconda Copper Tubes are busy serving industry in thousands of different ways. When you turn to copper remember Anaconda. The American Brass Company.

84—See page 31. Flexible Metal Tubing and Metal Hose: Write for literature describing the many uses and types for handling steam, water, oil, solutions, semi-solids, or gases. American Metal Hose Branch, The American Brass Company.

85—See page 167. Pipe Fabricating Specialists: Meet your most exacting specification with absolute satisfaction on all pipe fabricating for Oil, Chemical, Concrete, Asphalt, and other industrial requirements. Fabricating Division, Albert Pipe Supply Co., Inc.

86—See page 122. Ball Bearing Swivel Joints: Available in over 500 types, styles, and sizes—in steel, malleable iron, bronze and aluminum. Write for latest catalog. Chiksan Company.

87—See page 112. Cast-Iron Fittings: Handy pocket gage available for measuring pipe sizes. Contains a table of theoretical allowances for make-up when pipe is forcibly screwed into fittings. If you'd like to have one of these gages, mail your request today. The Kuhns Brothers Co.

88—See page 125. B & W Tubes: The B & W Tube Company representatives are pass keys to all tubing problems—pressure or mechanical—carbon, alloy, or stainless—special shapes—tailor-made physical and chemical properties. Trained in "tube-technics". Experienced in uncovering unexpected tubing economies. Write for name of representative near you. The Babcock & Wilcox Tube Company.

PLANT EQUIPMENT

89—See page 152. Steel Grating: Bulletin KL 1140 fully describes the Dravo line of Tri-lok grating, safety treads, open steel flooring, concrete armoring and other products. Send for your free copy. Dravo Corp.

90—See page 168. Carry-Tool: A new Hallowell time-saver. Sturdy, easy-rolling, handy. Made of heavy-gauge steel with large drawers for tools. Ball-bearing rollers. Get full details in Bulletin 715. Standard Pressed Steel Co.

POWER TRANSMISSION

91—See page 128. Flexible Couplings: New engineering catalog gives full information on these all metal couplings designed to eliminate backlash, friction, wear and cross-pull. Thomas Flexible Coupling Co.

92—See page 70. Whipcord Endless Belts: Manufactured to meet drive requirements of short centers, small pulley diameters, high speed and smooth operation. Write today for Folder No. 6868C. Raybestos-Manhattan, Inc.

93—See page 158. Fan-Cooled, Worm Gear Speed Reducers: Write for Catalog 200 for standard drives, and Catalog 300 on Speedaires that do more work, deliver double the horsepower of standard worm units of same frame size. Save money, space, and weight. The Cleveland Worm & Gear Co.

94—See page 175. Roller Chain Drives: Diamond Chain offers the machinery designer the same advantages for intra-machine applications as it does for the primary drives. Wherever shafts are to be driven, regardless of speed or direction of rotation, Diamond Roller Chains can do the job efficiently. Write for full details. Diamond Chain Company, Inc.

95—See page 136. Variable Speed Pulleys: Instant speed change to fast or slow, for old or new equipment. Fractional to 8 hp. Easily installed. Ratio 3:1, infinitely variable. Low cost. Deliveries from stock. Wide V-belt series. Write for your copy of free catalog today. Lovejoy Flexible Coupling Co.

96—See pages 48, 49. Torque-Arm Speed Reducer: A new tool for mechanical transmission of power. Practical in design. Effective in operation. Low in cost. Promises to benefit industry as extensively as the famous Dodge-Timken Bearing, Rolling Grip Clutch and other Dodge "firsts". Write today for Bulletin No. A470 with details, specifications and easy-to-use selection tables. Dodge Manufacturing Corporation.

97—See page 39. V-Belt: Yours for the asking. Two valuable "tools" of V-belt drive design and application. (1) "Guide for Selecting or Designing V-Belt Drives". (2) Gates "Industrial News", published monthly. Use coupon on page 39. The Gates Rubber Company.

98—See page 149. Plate Fasteners for Conveyor Belts: Write for catalog describing their special design that spreads tension evenly and makes joints dust- and watertight. Sizes for belts ¼" to 1½" thick. Armstrong Bray & Co.

PUMPS

99—See page 134. Centrifugal Pumps: Write for Bulletin No. 3300-A. It's new and includes performance tables on the entire line of Deming Self-Priming Centrifugal Pumps. The Deming Company.

100—See page 166. Free Bulletin: For complete information about Viking Pumps, write for Bulletin 50SG. You'll find the style and size you need, correctly engineered to do your job, Viking Pump Company.

101—See page 128. Safe-Fast Acid Pump: For carboys, drums and barrels. Smooth flow right from the start—no dangerous spurts or splashes. Equipped with flexible Saran tube and adapter for openings larger than 2¼ dia. Send for complete data today. General Scientific Equipment Co.

102—See page 21. Motorpumps: No matter how special your requirements, you may get exactly what you want from ¼ to 40 hp, from this complete line of Ingersoll-Rand Motorpumps. Check page 21 for description of standard I-R Motorpumps. Whatever your pump problems, write to Ingersoll-Rand.

103—See page 111. Hydroplex Pump: Engineered for economical boiler feed service. Capacity range from 10 to 140 gpm at heads of 450 to 1700 feet. Operates at high speeds —3550 rpm on 60 cycle and 2950 on 50 cycle and higher in special units. More information on request. Byron Jackson Co.

104—See page 117. How to Stop Worrying about Pumps: Contact a Welnman centrifugal specialist through an inquiry today for complete information on the right pump for the right job in your plant. No obligation. The Welnman Pump Mfg. Co.

105—See page 15. Worthington Standard Pumps: Complete line of centrifugal, rotary, steam and power. You get dependability, long, low-cost service plus such outstanding developments as Monobloc Centrifugal (designed with pump and motor as a single unit)—Regenerative Turbine (self-priming, self-venting, multi-vane impellers). Free bulletin available on all standard pumps. Write for your copy. Worthington Pump and Machinery Corporation.

REFRACTORIES

106—See page 162. Refractory Cement: This plastic chrome can be poured into any shape or form or can be installed with a cement gun. Ask for Bulletin R-48. Refractory & Insulation Corp.

107—See page 115. Refractories: Write for details on the B & W Refractories. Learn how they can cut operating costs in all types of industrial furnaces—large or small. The Babcock & Wilcox Co.

REGULATORS AND CONTROLS

108—See page 166. Multiport Valves: Use electrically operated H & T Poppet type multi-port valves to make your Zeolite Water Softeners or Sand Filters automatic. You get top performance at lower cost. Write for more details. Hungerford & Terry, Inc.

(Continued on page 156)

PLUGS ARE OUT WITH CHLORINATION

Costly plug cleaning, with its high labor bills and lengthy equipment down-time, goes out of the condenser and heat exchange picture the minute chlorination arrives.

This proven process for cutting the costly effects of back pressure and poor heat transfer characteristics caused by slime, really works, as one Southern Power Station found out when they began using the W&T De-sliming Process. In just six months after W&T Chlorinators were installed, cleaning and excess steam costs were reduced from $1450 per month to $250 per month and a later survey showed an overall saving in excess steam costs of $16000 in a year.

Such savings are indicative of how your condensers may be made to operate more economically and with far less outage when W&T Engineers install chlorination to fight your slime problems.

To learn how chlorination may be profitably applied to your heat exchange equipment and to take advantage of W&T's 35 years' experience, write today.

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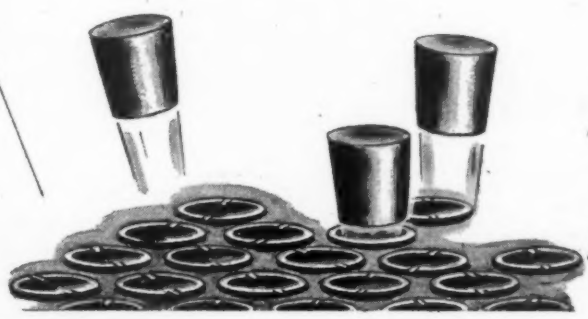

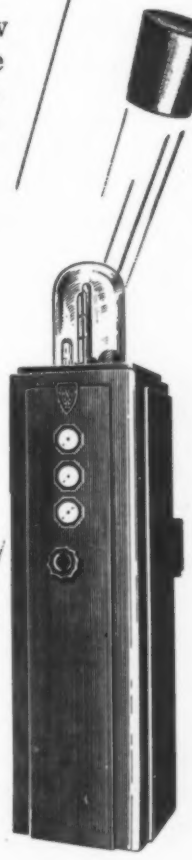

CD-31

READERS' GUIDE ... CONTINUED ...

(Continued from page 154)

109—See page 141. Pressure Regulators: Write for complete data on the Masoneilan No. 11 Pressure Regulators. Rugged construction means dependable operation—lower pressure reducing costs. Mason-Neilan Regulator Co.

110—See page 157. Floatless Level Control: Send for your copy of the new leaflet that presents this new floatless level control for boilers, tanks, evaporators, heaters, standpipes, etc. Leslie Co.

111—See page 118. Temperature Indicating and Recording Regulators: Their accurate control helps to improve quality of products—speed up production and save steam wasted by overheating. Write for Bulletin 370 which shows the variety of models available. The Powers Regulator Co.

112—See pages 22, 23. Fact-Filled Bulletin: You'll find complete engineering details and selection data on Spence Regulators in free Bulletin No. 5000. It features a full color, fully illustrated description of the operating cycle of a Spence Regulator. Send for your copy of this valuable bulletin today. Spence Engineering Company, Inc.

113—See page 168. Regulators and Thermometers: Write for Bulletins 500 and 1000 for full information on the Trerice Self-Operating Regulator and its companion piece, the Trerice Dial Thermometer. Their low initial cost will be repaid many times over during their first year of service. H. O. Trerice Co.

STEAM TURBINES AND ENGINES

114—See page 124. Steam Engines: Cut your power costs by putting steam fully to work. Use exhaust from the Troy-Engberg Steam Engine for your processing or heating, or both. Send for your copy of Bulletin 306. Troy Engine & Machine Co.

115—See page 62. Terry Turbines: Write for bulletin giving interesting facts about the outstanding features that make the Terry Solid-Wheel Turbine such a dependable driver. The Terry Steam Turbine Co.

TOOLS AND SMALL SPECIALTIES

116—See page 138. Small Tube Cleaners: With ROTOJET Junior Tube Cleaners you can clean tubes as small as .495" I. D. quickly and economically. No leakage. No stalling at low speeds. Send for ROTOJET Junior Bulletin. Elliott Company—Roto Division.

117—See page 6. Proto Tools: That's the new name for Plomb Tools, the leading brand of mechanics' hand service tools. Write for your copy of complete catalog showing this old reliable line of tools with the new name. Plomb Tool Company.

118—See page 130. Tube Cleaners and Expanders: Write for data on Airetool's cleaners that remove the most severe scale deposits quickly and safely from all sizes of bent and straight tubes. Write for further information on tube cleaners, tube expanders and accessory tools. The Airetool Manufacturing Co.

119—See page 142. New Tube Expander Bulletin: Write for Bulletin No. 68. Developed in condensed, easy-to-read form, with Specification tables for selecting the correct tube expander to meet your particular need. The Gustav Wiedeke Co.

120—See page 160. Tube Cleaners and Expanders: Bulletin 47-A contains complete information on Wilson standard tube cleaners that fit your special needs. Bulletin 380 for data on general tube expanders. Specify bulletins you want. Thomas C. Wilson, Inc.

121—See page 152. Portable Power Units: Beaver Model-C offers you the most in ruggedness and trouble-free performance. Gears fully enclosed. Safety switch-lock and chuck wrench holder. ½" to 2" chuck. Cast steel-iron housings. Weather-proof motor. Write for catalog and prices. Beaver Pipe Tools.

TRAPS, STRAINERS AND SEPARATORS

122—See page 63. Steam Trap Book: Send for copy of "Solving Steam Trap Problems" for more information on the uses of the three Super-Silvertop bucket traps for pressures up to 200 psi. The V. D. Anderson Company.

123—See page 24. Steam Trap News: Duo-Step Leverage increases trap drainage capacity over 100%. Available now in these Clark Steam Traps—71-D, 80-D series and 1800-D, 1900-D series. Send for the complete story now. The Clark Mfg. Co.

124—See page 120. Strainers: Bulletin S-201 describes strainers available in 6 sizes ½" to 2" for pressures up to 600 lb. Prevent rust, scale and dirt from clogging steam equipment. Yarnall-Waring Co.

125—See page 114. Steam Traps: Catalog No. 448 furnishes complete data on the Nicholson line of piston and weight-operated steam traps. Write for your free copy. W. H. Nicholson & Co.

126—See page 107. "Selecting Steam Traps": Send for your copy of this valuable Bulletin No 1600 to help you find the trap that's exactly right for any given application. Sarco Company, Inc.

127—See page 46. Improved Steam Traps: New stainless steel body makes the famous Yarway Impulse Steam Traps even better—at no increase in cost. Better in wear, better in service. Important—suitable for all pressures up to a specified maximum without change of valve or seat. Try the new stainless Yarways for better steam trap performance. Additional information sent on request. Yarnall-Waring Company.

128—See page 158. Better Drainage—Lower Cost: Positive and dependable. Maximum capacity with minimum weight and cost. Four designs and wide range of sizes. Long life and trouble free service. Write for bulletins containing complete details on the complete line of Stickle Steam Traps. Stickle Steam Specialties Company.

129—See page 151. No. 71 Airpel Steam Trap Steel Body and Cover: Approved by California State Department of Labor for use in petroleum refining plants. With increasing acceptance in chemical processing plants and for all types of marine service, this Wright Austin steam trap provides an extra factor of safety in accordance with current insurance codes, for all plants using steam. Send for Bulletin 604 with complete data and prices. Wright Austin Company.

VALVES

130—See page 170. Cold Water Valves: Needle valve control permits governing of closing speed to suit any operating need. Renewable cups and seat washer mean more economy. Write for descriptive technical catalog. Golden-Anderson Valve Specialty Co.

131—See page 34. Steel Valves: If you need gate, globe, angle, or check valves this company can provide you with an unusually wide variety for almost every engineering requirement. Write for Catalog No. 20. The Chapman Valve Mfg. Co.

132—See page 147. Butterfly Valves: Write for bulletins describing Rockwell valves for air, gas, liquids and solids. Any desired metal. Pipe sizes to 72". Pressures to 125 psi. W. S. Rockwell Company

133—See page 165. Water Gauges: Gauges opened or shut with one quarter turn providing quick shut-off of danger and expense. Steam proof and leak-tight. Meet A.S.M.E. Code. Send for a copy of Bulletin 471 for full information. The Paul B. Huyette Co., Inc.

134—See page 8. Piping Layouts: A new book of Jenkins Practical Piping Layouts—Nos. 26 to 50—is in preparation. Write now to reserve your copy. Jenkins Bros.

135—See page 163. Dual-Valve Blow-Off. A "regular" EVERLASTING valve that opens fully with one short movement of the lever . . . a wheel-operated EVERLASTING companion valve built to take the full punishment of the blow-off. For full information write for EVERLASTING. Bulletin. Everlasting Valve Co.

136—See page 127. Monel Trimmed Valves: Ask for: "Trimming Valve Costs with Lasting Trim". This new booklet tells you how to make valves last longer in many severe power plant applications. You can get several copies and route them to interested members of your organization. The International Nickel Company, Inc.

137—See page 142. Multiport Relief Valves: Provide protection against over pressure and consequent damages that may result from use of single disc relief valves subject to sticking, jamming, over-weighing or tying down. Write for Publication 4150. Cochrane Corp.

138—See page 64. Lunkenheimer Service: Representatives and Sales Engineers will be glad to work with you on any problem of valve installation and usage. Check with your Lunkenheimer Distributor for immediate maintenance requirements. The Lunkenheimer Co.

139—See page 158. Better Steam Control: Write for specifications and engineering data on Stickle Valves. Series 200 Double-seated Semi-balanced Valves—Bulletin No. 235. Series 400 Single Seated, Balanced Valves—Bulletin No. 435. Stickle Steam Specialties Company.

140—See page 3. Safety Valves: For full details on the design and construction features that enable Foster 38-SV Safety Valves to outperform ANY other safety valve, get in touch with your Foster Representative or write directly to Foster Engineering Company.

WELDING EQUIPMENT

141—See page 40. Prest-O-Weld Blowpipe: Write today for complete data. Sturdily built. Has all 'round efficiency. 13 standard and 4 extra-long sizes of welding heads. Completely dependable. The Linde Air Products Co.

MISCELLANEOUS

142—See page 162. Combustion Engineering Course: Send for book "Opportunities for the Combustion Expert," which offers a complete outline of the Hays Home Study Course. Hays School of Combustion.

143—See page 143. Automatic Printing Calculators: The only calculator that multiplies and subtracts, and prints every factor and answer on the tape for *immediate* proof of accuracy plus *permanent* proof for your records. An inquiry will bring you complete cost-cutting information. Remington Rand, Inc.

144—See page 170. Power Plant Engineers' Guide: A complete steam engineers' library in one book—1500 pages, 65 chapters, and 1700 illustrations. Mail coupon on page 170 for a 7 day free trial offer. Audel Publishing Co.

145—See page 126. Electri-conomy Typewriter: Now you can increase your typing production 10% to 50% with the new Remington Electri-conomy. It will pay you to send for your free copy of "Electric Typing vs. Manual Typing". Remington Rand.

146—See page 149. Important Booklet: Send for free copy of 40-page brochure of up-to-date facts and figures—a valuable study for anyone considering a cost-saving manufacturing and distributing location on the Atlantic seaboard. "Industrially Yours—New Jersey" belongs on your desk. New Jersey Council.

147—See page 165. Plastic Sleeves: Topflight plastic sleeves, extruded in plain colors or in bands of colors, for marking tubing, cables, sub-assemblies, parts. Easily and quickly applied—last indefinitely. Write for full information. Topflight Tape Co.

148—See page 169. Check This Economy Move: Over 1900 firms supply the more than 33,000 products which Hajoca stocks for industry. Use this one source and eliminate your high cost of dealing with many sources of supply for the industrial products you use. Hajoca Corporation.

"SPOT" NEWS OF INDUSTRY

(Continued from page 117)

A 200 foot under-the-floor double conveyor, with openings by each cutting machine, takes care of scrap disposal, carrying it from the cutting department to the baler. A corrugating machine of the latest design, 78 inches wide, is capable of corrugating up to 400 feet of board per minute.

Transportation facilities are equally efficient on the outside of the plant. Truck and railroad sidings run the length of both sides of the building where loading platforms can accommodate 50 trucks and 22 box cars at one time

Radio Station Increases Efficiency of Maintenance Departments

Techniques learned during the war on communications have been put into effect at the A. E. Staley Manufacturing Co., Decatur, Illinois. The company owned station KSA 419 has two-way conversations between maintenance headquarters and cranes, trucks, fork tractors, and repair personnel throughout the plant.

"When a breakdown occurs a certain number of employes must just stand by and wait until the repairs are made", Charles F. Gebhardt, superintendent of maintenance, said. "Delays for repairs may mean the difference between operating at a profit or a loss for that particular period. We hope to speed up our repair operations with this new installation".

Application of the system means less outage time and a more efficient maintenance department. For example if a motor failure occurs, an electrical repair crew working

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LEVEL CONTROL
for BOILERS, TANKS, EVAPORATORS, HEATERS, STANDPIPES, etc.
A simple solution to a troublesome problem
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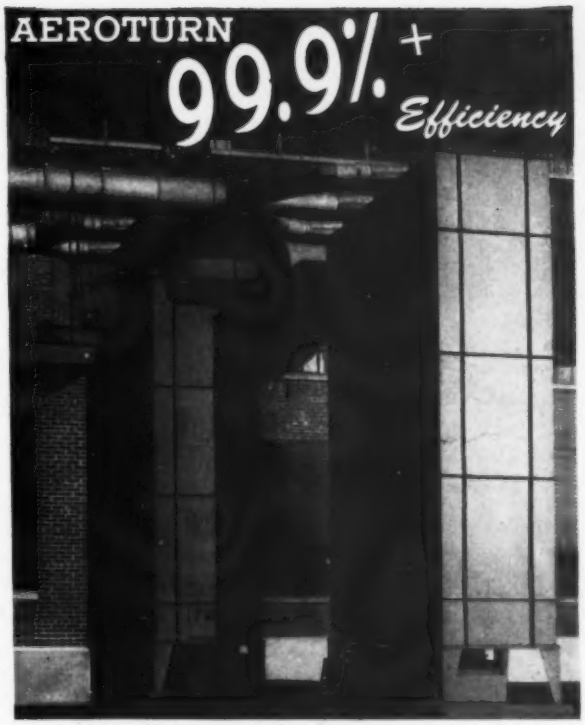

On actual industrial installations, not laboratory tests, the AEROTURN Dust Collector turns in a consistent 99.9%+ filtering efficiency performance. Naturally, that's hard to beat.

And this efficiency is not at the sacrifice of size or filtering rates - Aeroturn Collectors are 50-75% Smaller than others that do the same job. Filtering rates run up to 60 feet per minute.

How is all this possible? - The Aeroturn is a Fully Automatic, continuous operation bag type collector. It uses advanced filtering medias that easily handle dusts even in sub-micron classes. No stoppage for cleaning, no bag shaking. Cleaning is an automatic, intermittent process. The collector can run 24 hours a day with no attention required.

Aeroturn will solve your dust-separation problem no matter how difficult it is. Send for Aeroturn literature today.

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To select the proper drive for any type of service

GET your copies of the latest Cleveland catalogs for full information on all types and sizes of worm gear speed reducers —including rating tables, dimensional diagrams and data for both standard and fan-cooled units. Ask for Catalog 200 for standard drives and Catalog 300 for Speed-aire (fan-cooled). The Cleveland Worm & Gear Co., 3253 E. 80th St., Cleveland 4, O.

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Speed Reducers

For personalized service: Write or phone John E. Millikan Cleveland exch. Vulcan 3-4560

on a "non-rush" job can be found quickly and dispatched to the scene. If inspection shows the motor cannot be repaired on the job the dispatcher is notified and a similar motor is ordered from stock. The dispatcher radios a truck or tractor unit to pick up the motor and deliver it.

In some cases the motor replacement will be delivered before the repair crew has the old motor off the motor base. Under the old system much time was lost because someone had to be sent to contact the repair crew. If inspection indicated a replacement, more time was consumed on a trip to the warehouse for the stock motor. The time lost by the repair crew might be only an hour or so, but a good many hours would be lost by the employes whose work was halted when the motor failed.

"Nerve center" of the maintenance operation is the dispatcher's office. In normal procedure, the foreman in a particular part of the plant calls the dispatcher and informs him of needed repairs. A repair order is made out by the dispatcher and sent by pneumatic tube direct to the desks of the maintenance foremen who will be responsible for the repairs. In some cases the services of three different crafts may be required for a single job and they will all receive orders at the same time. A copy of the order also goes to the tool rooms and the materials supply rooms, where the stockroom men are alerted to be ready to deliver the needed materials.

High Costs Eliminate Atomic Power as Competitor in Nation's Power Picture

Speaking before the 12th annual joint Fuels Conference of the American Society of Mechanical Engineers and the American Institute of Mining and Metallurgical Engineers, Ward F. Davidson, research engineer for the Consolidated Edison Company of New York, predicted that high costs of

BETTER DRAINAGE AND REDUCED COST WITHIN YOUR GRASP!

Why put up with inefficient drainage and exorbitant steam costs? Stickle Steam Traps are economical in first cost, in installation and in maintenance, proved in thousands of industrial applications. They are positive and dependable in operation and simple in construction — offering ***maximum capacity with minimum weight and cost.*** Made in four designs and a wide range of sizes for most efficient operation in all types of service. Stickle open float principle, location of valve and seat in top of trap, the internal strainer and internal by-pass for air — all combine to provide the utmost in ***long life and trouble free service.*** The series 100 trap, illustrated here, weighs only 4½ lbs. but has a capacity of 500 pounds per hour. Write for bulletins describing the complete line of Stickle Steam Traps, and our recommendations for your particular needs.

BETTER STEAM CONTROL

Stickle Valves — made to meet specific operating conditions — are accurate, sensitive, and dependable. They meet all requirements for complicated pressure regulation and exacting control, being especially designed for use where control of pressures within extremely close limits of variation is essential. Simple. Compact. Easy to install. All parts renewable. Two series, in small to large sizes. Specifications and engineering data in bulletins . . . Series 200 Double-seated Semi-balanced Valves, Bulletin No. 235. Series 400 Single Seated, Balanced Valves, Bulletin No. 435.

STICKLE STEAM SPECIALTIES COMPANY — 2227 Valley Avenue, Indianapolis, Indiana

building and operating an atomic power plant preclude any possibilities that nuclear power will make any large-scale inroads into industrial power production in the near future. At most, Mr. Davidson said, nuclear power plants might represent much of the new capacity and thus supplement rather than substitute for power from coal, oil, gas, and water.

According to Mr. Davidson, large nuclear power plants are possible from a technical viewpoint, but their economic feasibility is another matter. He mentioned fundamental design problems, the search for materials able to withstand neutron bombardment and radiation intensities existing in a nuclear reactor and the choice of nuclear fuel as problems of the first magnitude that face physicists, metallurgists and engineers.

"A large high-efficiency coal-burning power plant today will cost something like $190 per kw", said Mr. Davidson. "Of this, about one half, or, say $100 per kw would be needed for the part that would be duplicated in a nuclear power plant. No adequate basis exists for a sound estimate of the other costs, but a reasonable assumption is that they will be at least three times those of the coal-burning station. This gives a figure of $370 per kw for the complete nuclear power station".

On the subject of operating costs, Mr. Davidson had this to say: "The largest item for coal-burning stations is fuel. For the nuclear station, fuel costs could conceivably be far lower if ample supplies of uranium ores are found and if present costs of reclaiming and reprocessing the partially-spent uranium could be reduced. Under present conditions, uranium as a fuel for power plants is much more costly than coal, but at some later date atomic fuel may become somewhat less expensive. As to other operating costs, until extensive experience with nuclear power plants has been obtained, labor, supervision, maintenance and repair are all

Is this the solution to your lubrication problems, too?

FOR more than 20 years, Farval has been saving money for users. Through efficient, dependable lubrication of machines and industrial equipment of all kinds, Farval saves 4 ways: It saves oiling labor, it saves lubricant, it reduces bearing expense, it eliminates down time.

The Farval System is a positive mechanical method of delivering oil or grease under pressure to a group of bearings from one Central Station, in exact quantities, as often as desired. It consists of a central pumping unit, two main supply lines and a measuring valve for each bearing.

Catalog No. 25 and "Case Studies" give you the facts and figures. The Farval Corporation, 3253 East 80th Street, Cleveland 4, Ohio.

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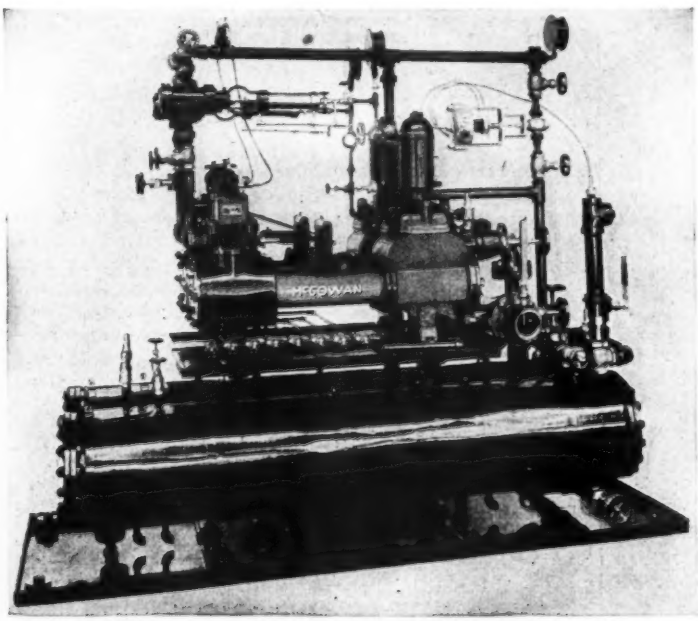

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Standard sizes up to 50 GPH of No. 6 fuel oil. Accessories to suit.

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DON'T BE A LATE STARTER

1950 promises to be a tough, competitive year. One way you can get a fast start on profitable operation is to use standard Wilson-Dudgeon Tube Expanders to help solve your production or maintenance problems on tubular apparatus. Backed by 97 years of solid experience, Wilson-Dudgeon Tube Expanders will assure you of fast, easy, reliable tube rolling to cut down-time and increase production-time. Here are two of the profit-making Wilson-Dudgeon Tube Expanders:

Wilson-Dudgeon Model 38 Tube Expander for tubes 1" O.D., up. Self-feeding, parallel rolling and flaring action seats tubes quickly and solidly.

Wilson-Dudgeon Model 41 Tube Expander, parallel rolling, self-feeding with ball bearing thrust collar for rolling heat exchanger tubes ½" O.D. to 2½" O.D., into tube sheets to 6".

No matter what your tube expander problem, you can be sure of getting a Wilson-Dudgeon Tube Expander that will fit your specific application. Write us, giving full details or send for Bulletin 380.

CUT FUEL COSTS *with* WILSON TUBE CLEANERS

Remember—1/16" of scale often wastes 10%, or more, in fuel. A Wilson Tube Cleaner makes short work of the toughest deposits . . . cleans both ferrous and non-ferrous straight or curved tubes. Air, steam, water or electrically driven cleaners available for tubes 3/8" I.D., to the largest ever cleaned. Write for Bulletin 47-A.

THOMAS C. WILSON, INC., 21-11 44th AVENUE, LONG ISLAND CITY 1, N. Y.

WILSON

WILSON TUBE CLEANERS
WILSON-DUDGEON TUBE EXPANDERS

likely to be higher than for coal or oil-burning stations.

In addition, other factors must be considered. In making a comparison of nuclear and fuel-burning power plants, the assumption cannot be made that they can be placed on sites equally advantageous with relation to the load. Until years of successful operation have proved their reliability, no prudent engineer would place a large nuclear power station in the heart of a large city or in densely populated or industrially important areas. The ever present chance, however small, that something might go wrong and release large amounts of intensely radioactive material would dictate sites in areas where a failure would be less disasterous. This may necessitate added transmission, the costs of which must be considered.

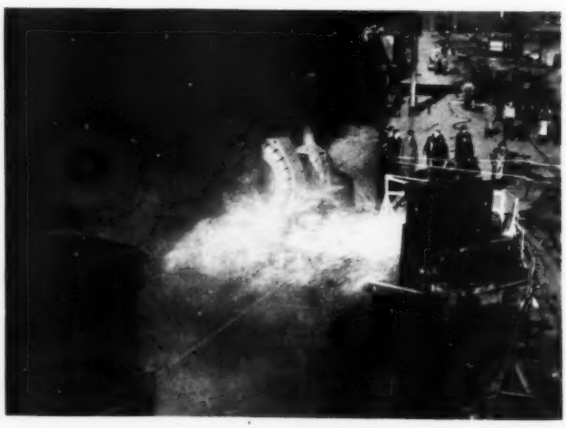
Disposal of radioactive wastes presents many problems for which solutions may be found only by distance from centers of population. Of course shipment of wastes in suitably shielded cars or ships is possible, but the costs of such operation cannot be ignored.

Almost regardless of what costs may be for nuclear fuels, the energy per unit weight is so great—about three million times that of coal—that shipping costs of uranium will be practically negligable as compared with those for coal or petroleum or transmission costs for natural gas. Therefore, in the absence of tariff barriers and artificial price control, the fuel cost will be the same at any place in the world.

One claim for nuclear power plants is that they offer particular advantages in areas where adequate supplies of condenser cooling water are not available in lakes or rivers. But this does not meet the test of critical analysis. A heat engine, a steam or gas turbine is required in either a nuclear or a fuel-burning plant and the conversion efficiency will be influenced equally by the availability or lack of cooling water. Higher final temperatures mean lower efficiency, larger turbines, larger steam generators, larger reactors, and so forth, and they mean higher fuel consumption. All that can be said with certainty is that at some time in the future nuclear power plants may not be influenced as adversely as fuel-burning power plants by lack of natural cooling water supplies.

Artificial "Storm" Created to Test Motor

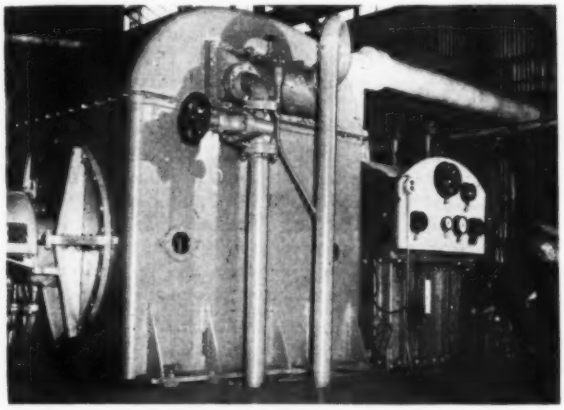
At a preview showing in sub-freezing temperature, General Electric's new modified base-ventilated motor demonstrated its ability to withstand hurricane conditions. A 60 mph air current was created by a motor driven airplane propeller and used to throw a stream of water, which was shot out of a fire hose at high pressure, against a steel "back board". The "back board" broke up the stream into a rain-like spray, directing it at the motor under trial, which was mounted on a concrete base raised from the ground to allow



contaminated ambient air to flow through the foundation at high velocity, as in a storm. The freezing particles adhered to the base and the housing and shaft of the motor, but did not hinder its operation in the least. After 30 minutes of this treatment the motor was disassembled. Its coils, inner air passages, and bearing housings were completely dry.

Western Lumber Company Uses Reconverted Navy Generators

Two General Electric turbine generators that served during the war on a Navy destroyer escort vessel, have been converted to industrial use to provide power for the Saginaw-Manistee Lumber Company at Flagstaff, Arizona.



Converted at the General Electric Company's Los Angeles service shop, the generator stators were completely rewound, the governors changed for constant speed operation at 3600 rpm and provided with a governor motor and synchronizing control. The generators are now rated at 2400/4160 v, 60 cycle, with a capacity of 1700 kw.

Jamaica Bauxite to Expand Aluminum Industry

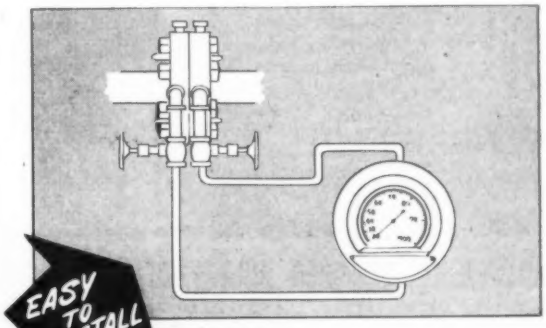
An extensive mining project, undertaken under the Marshall Plan in cooperation with the British and Jamaican governments, is expected to augment the aluminum reserves in this country. An aggregate expenditure of about $14,500,000 is contemplated. Already $1,000,000 has been expended by Reynolds Metals Company in exploration, drilling, and research in connection with the Jamaica bauxite. The company plans to spend an additional $1,000,000 to provide unloading facilities at a gulf port in the United States and handling facilities at their Hurricane Creek alumina plant in Arkansas.

The project is the result of the discovery of vast bauxite deposits on his 4000 acre cattle ranch in Jamaica by Sir Alfred D'Costa in 1942. Since that time Reynolds Metals Company has conducted extensive research on the ore and found it to contain approximately 50% alumina with the impurity silica unusually low, ranging from ½% to 2½%. The use of low-silica ore to supplement the high-silica Arkansas bauxite will extend the productive life of the Hurricane Creek plant by many years, it was stated by R. S. Reynolds, Jr., president of Reynolds Metals Co. In addition the Jamaica reserves are estimated to be several times as large as the total known reserves of both high and low grade bauxite in the United States.

Other advantages of the Jamaica ore include the location of Jamaica itself. Located 1500 miles closer to U. S. ports than British and Dutch Guiana, where bauxite to meet our domestic scarcity has formerly been imported from, it will

There's no gauge like FLO-GAGE for simplicity, economy, and all-around usefulness. Now, this compact rate of flow indicator packs another big feature: *positive, automatic protection against overloads and reverse differentials!*

Other features of the Builders FLO-GAGE: Accurate — easy to read — low cost — requires no mercury or auxiliary power supply — no stuffing box — negligible maintenance — simple design — durable construction — ideal for water, steam, air or gas lines. For information and descriptive Bulletin, address Builders-Providence, Inc. (Division of Builders Iron Foundry), Providence 1, R. I.



with orifices or other differential producers.

BUILDERS PRODUCTS

Flow meters and controllers . . . mechanical and differential . . . for liquids, steam, air, and dry materials. *The* Venturi Meter • Chlorinizers-Chlorine Gas Feeders

BUILDERS PROVIDENCE *Instruments*

KNOCK OUT *Boiler Scale* WITH

SAND-BANUM

THE PURE, COLLOIDAL CONCENTRATE

Guaranteed Harmless to Personnel and Equipment.

Use Ounces Only — Once a Week.

SAFE — CERTAIN — SIMPLE — ECONOMICAL

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ERNST WATER COLUMNS

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For Every Application

Split-Gland Water Gages
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Sight Flow Indicators
Safety Plastic Guards
Sight Glass and Discs
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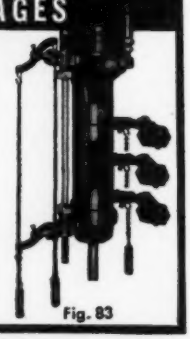

Fig. 83

WRITE FOR BULLETIN

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LIVINGSTON, N. J.

COMBUSTION ENGINEERING

for power plant men . . . Become a trained combustion Engineer the easy HAYS way. Firemen, engineers, fuel and equipment men, etc., can earn bigger pay by becoming a Hays trained combustion engineer. Many employers recognize a HAYS-TRAINED engineer as a better man. Just a little of your spare time required for the simple, easy-reading Hays Home Study Course. Hundreds of others have made better jobs for themselves through Hays training. So can YOU.

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be of great strategic advantage in case of emergency. Also the Jamaica bauxite occurs so near the surface that it can be mined after removing nine inches of overburden. Much of the South American ore requires extraction of two or three tons of material and washing of such material to recover one ton of high grade bauxite. The Jamaica ore can be used in its natural state without washing, and the facilities there will include a drying plant to reduce the moisture content and eliminate dust before shipping and handling.

Louisiana, Mo., Demonstration Plant Converts Coal to Oil

Latest information released by the Department of Interior reveals that the Coal Hydrogenation Demonstration plant at Louisiana, Mo., has completed a continuous 7 week initial run. Coal-tar oil and coal was converted to gasoline and other liquid fuels. (See August 1949 Industry and Power "Complete Coal-to-Oil Demonstration Plants" starting on page 90).

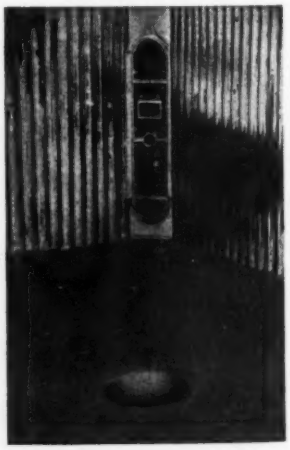
Actual "break-in" operations were started on October 12, 1949 when an initial charge of high-temperature coal-tar was made. The charging stock and hydrogen were circulated at full pressure (10,000 psi) and heated gradually until a temperature of 850° F was attained. The tar oil hydrogenation was conducted at this reaction temperature level. When all the available stock was utilized, a paste containing 25% Wyoming bituminous coal was introduced. The run continued satisfactorily until terminated seven weeks later, as planned.

Detailed operational and production data were recorded but not considered representative as the run was purely for break-in purposes and was larger explanatory. However, the recent liquid-phase run was the first time that coal

Reduce Boiler Outage With R & I Moldit Chrome

A large refinery plant was taking the time and trouble to replace the floors of their boiler by pounding a refractory in place. The average life of the floor was 44 days.

Then they switched to R & I Moldit Chrome, a castable refractory, which when mixed with water can be poured, troweled, shoveled or shot in place like concrete. Considerable installation time was saved and a service check at end of 96 days showed the Moldit Chrome still in good condition.



Many plants are now using this castable for both floors and walls of oil and coal-fired boilers. No pounding or ramming is needed and the life is longer.

Ask your supply house for R & I Moldit Chrome. Write us for Bulletin R-48.

R&I

REFRACTORY & INSULATION CORP.

118 Wall St., New York 5, N. Y.

Chicago 4, Ill., Newark 2, N. J., Philadelphia 2, Pa.

tar and coal paste feed stocks were converted to synthetic oils. Gasoline, naphtha, and vapor-phase charging stock were produced.

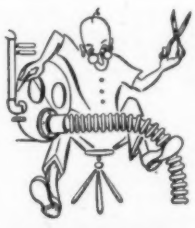
Aircraft Turbojets Ready for Commercial Use

According to C. W. LaPierre, manager of General Electric Company's Aircraft Gas Turbine Divisions, jet engines are ready for commercial transportation use. This industry has moved very rapidly in the past 10 years, he pointed out, and the speed and reliability of jets will be major factors in their acceptance. At speeds above 500 miles per hour the turbojets provide more economical operation than any other power plant visualized. Along engineering lines, progress has been toward longer times between overhauls and lower fuel consumption. Not only are the wearing surfaces of a turbine almost non-existent, but great progress has been made in the production of metals to withstand heat and in designing protection of parts against heat. The Civil Aeronautics Administration recently certified General Electric's TG-190-B turbojet for commercial use.

Employ Dual Fuel Diesels at Sewage Disposal Plant

When completed, the new Hyperion sewage treatment plant, being built by the city of Los Angeles at El Segundo, California, will be among the most advanced in the world. Designed to meet the requirements of a population of 3,000,000 persons, the estimated cost of the plant is $41,000,000.

Included in the main power items will be nine Worthington supercharged dual fuel 8-cylinder Diesel engines, built



We Tailor Hose to Your Design

Each industrial forward stride has brought its own O. E. design problems. Where flexible metal hose could do a *better* job, ATLANTIC engineering has participated: Filters, turbocharged diesels, dust collectors, seeding equipment, rocket test cells—and more.

If your design problems involve vibration dampening, connecting misaligned structures, mobile services . . . conveying oil, gases, chemicals, steam, compressed air, light or semi-solids under pressure and temperature extremes, we offer the help of 30 years' engineering experience.

Seamless or interlocking flexible metal hose for every known application. Bronze, steel or stainless steel as required. 1/8"-36" I. D. inclusive. Standard or special couplings, flanges, nipples, fittings.

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DOUBLE SAFETY FOR YOUR BOILER BLOW-OFF

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EVERLASTING DUPLEX UNIT

There's *doubly-safe* boiler blow-off action in this EVERLASTING Duplex Unit.

The STRAIGHT-THROUGH TYPE on the left gives you wide-open, full-pipeline flow with a quarter turn of the lever. It's designed so that no damaging grit can lodge between the seat and the sealing disc . . . and the more the valve is used, the more the self-lapping action of the disc rotating across the seat *improves* the drop-tight seal.

The ANGLE TYPE on the right is stoutly built to withstand the blow-off shock. It takes the punishment, all right . . . *and endures.* Abrasives can't hurt this valve, either, because there are no pockets where they can lodge.

Thus, this EVERLASTING Valve team assures practically *zero maintenance* as well as *double safety.* Conforms to ASME and other codes . . . made in sizes 1½-in., 2-in. and 2½-in. for pressures up to 600 psig . . . and either valve available separately in cast iron or steel. Write today for full information without obligation.

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Everlasting Valves

for everlasting protection

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MOVES LOADS EASIER - FASTER - SLASHES COST OF MATERIALS HANDLING

At your service *24 hours every day* because it is gasoline-powered (no layups for battery charging). Works inside and outside your plant. ***KRANE KAR*** serves also as an auxiliary to existing crane facilities . . . and as an emergency tool for plant maintenance. *Let us show you.* Ask for Bulletin No. 79 or for a Sales-Engineer.

***KRANE KAR** handles loads at Sides as well as at Front.*

1½, 2½, 5 and 10 ton capacities.

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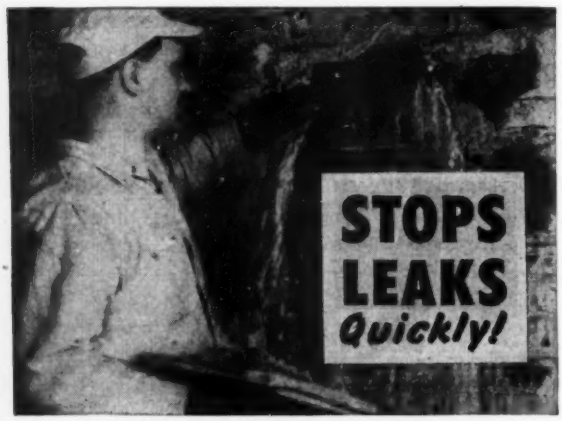

MAKES BASEMENTS DRY!

Leaks in concrete walls can be stopped quickly with FLEXTITE. Actually seals against water pressure. Efficient as a plaster coat for sealing off water and dampness. Converts wet basements into dry useful space. Used in elevator pits, tunnels, dams, tanks, retaining walls. In reconstruction work, broken pillars and beams can be quickly reshaped with FLEXTITE.

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to operate on either gas or oil fuel or on any ratio of the two. The engines will normally run on raw sewage gas, but in the event of a shortage or failure of the gas supply the governor on each engine will automatically increase the oil fuel supply to compensate for the reduced gas supply. Five of the Worthington engines are being installed in the power plant to drive a-c generators which will produce the electricity to drive the various equipment in the plant. The remaining four engines will drive 2-stage centrifugal blowers, supplying air for the treating process.

The efficiency of the dual fuel engines is further increased by supercharging to allow maximum power for a given space allotment and also produce the highest thermal efficiency. In addition, a still greater overall thermal efficiency results from the use of a high temperature cooling water system and exhaust heat recovery, which converts waste heat into usable energy in the form of steam.

Giant Ram Trucks Lift and Carry 60,000 Pounds of Steel

Engineered to handle the widest and largest welded steel coils now being produced, two giant ram trucks enable steel producers to keep abreast of the latest steel mill processes. The trucks, each capable of handling 60,000 pound coils of steel, have been built and delivered to the Great Lakes Steel Company, Detroit, by the Automatic Transportation Company of Chicago. The ability to handle these large coils effects a great saving in steel mill operation because it permits more coils to be welded together, thus reducing the number of times the mill must be shut down for rethreading.

AVAILABLE REPRINTS

Copies of the complete editorial section of the September, 1949 issue, describing the plant engineering activities of the General Motors Corporation are available in a separately bound brochure. Price including mailing is 50 cents.

We also have a few of copies of the following article reprints that are available free of charge to interested parties:

"Chain Belt's Newest Boiler is First 'Step' in 3-Step Plan", W. J. Thuerman, October, 1949.
"Commercial Solvents Installs Boilers Out-of-doors", E. E. Kantz, April, 1949.
"Crankcase Explosions are Rare—But . . ." October, 1949.
"Electro-Motive's Steam Plant is Tops in Modernity", V. L. Wesby, September, 1949.
"Engineers 'Raise the Roof' for Harnischfeger's New Boiler", Anthony Sinclair, December, 1949.
"GM 'Utilities' Receive Major Attention". H. R. Smith, September, 1949.
"Insulation on 2000 psi Boiler Proves Effective", R. H. Boothby, October, 1949.
"Keep It Clean, says Oldsmobile", R. H. Barlow and W. E. Rasmussen, May, 1949.
"Modernization at Toledo Laundry Cuts Steam Costs in Half", H. A. Quinn and S. T. French, October, 1949.
"Petoskey Diesel Plant Designed With An 'Eye-To-The-Future' ", May, 1949.
"Qualifications of an Effective Industrial Supervisor", A. A. Potter, June, 1949.
"Select Correct Batteries for Starting Diesels", K. A. Vaughan, November, 1949.
"Simplify Determinations of Pipeline Pressure Losses", J. O. Mullen and H. D. Fisher, November, 1949.
"Solvents vs. S'udge", Frank Ross, January, 1949.
"Steam, Air, and Power for 3 New Ford Assembly Plants", R. M. Doering, May, 1949.
"Supervisors Must Develop Favorable Group Attitudes", Edmund Motterhead, November, 1949.
"The Story of Thermal Electric", A. G. Purdue, March, 1949.
"Unit Heaters Require Proper Steam Traps", P. J. Ulrich, March, 1949.
"Water Treatment for Air Conditioning Systems", Wm. A. Tanzola, May, June and July, 1949.

Portable Elevators Effect Great Storage Savings

Overhead space can be utilized when portable elevators are employed to pile materials for storage ceiling high. Utilization of this space reduces actual floor space needed for storage. It means less fuel or refrigeration, illumination, labor, building maintenance, and rent, if the building is rented. Barrett elevators, manufactured by the Barrett-Cravens Company, Chicago, can be operated by one man to lift and store boxes, cartons, crates, bales, sacks, bundles, skid loads, box loads and pallet loads. Materials and products which cannot be piled may also be stored ceiling high by these elevators, with the aid of storage racks or stacking frames.

Rust Inhibitor Used on Public Streets and Highways

A rust inhibitor, manufactured by Calgon, Inc., is being mixed with de-icing salt in many municipalities as well as on county and township roads this winter, to prevent corrosion on public and private vehicles. Originally developed for rust-proofing of fabricated iron or steel products or parts for military equipment, during the war, and since then used for a variety of civilian goods, the rust-inhibitor is now being mixed with salt to melt snow and ice from traffic ways. When the brine slush is splashed against fenders and underbodies of streetcars, buses and other vehicles, the rust-inhibitor forms a microscopically thin and invisible, yet tough and protective film on exposed metal surfaces. This film effectively seals the metal surfaces against the normally corrosive effect of salt brine, moisture and oxygen.

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---is designed to help

SOME PLANT MANAGER CUT PRODUCTION COSTS!

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THAT'S IMPORTANT NOW!

This data may have the answers to some of YOUR PROBLEMS

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Bowser offers you *proved* ways to reduce labor, speed production, prevent inventory losses and minimize maintenance. Some of them may be just what *your* plant needs.

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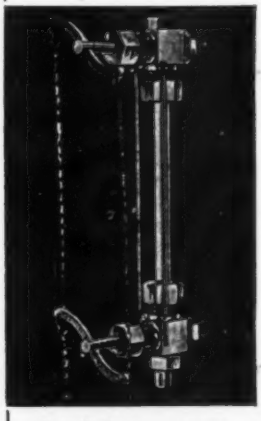
LIQUID CONTROL SPECIALISTS SINCE 1885

PBH Water Gauges

QUICK CLOSING—Gauges opened or shut with one quarter turn providing quick shut-off of danger and expense.



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MEET A. S. M. E. CODE. Valves are made of A.S.M.E. bronze stamped with maximum working pressure. Operating chain handles furnished complying with Code requirements.

All valves rigidly tested and inspected before shipment.

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FOR MARKING TUBING, CABLES SUB-ASSEMBLIES, PARTS

Topflight plastic sleeves are extruded in plain colors or in bands of colors. All standard and Army-Navy color codes. Printed by hot-stamping method, legends can not be effaced in normal use. Sleeves are formed to proper diameters, easily snapped in place and held permanently by Topflight bonding fluid. Easily and quickly applied - last indefinitely. Write for full information, stating your needs.

ALSO TOPFLIGHT PRINTED PRESSURE-SENSITIVE TAPES — TOPFLEX AND TOPFLEX, JR.

TOPFLIGHT TAPE COMPANY

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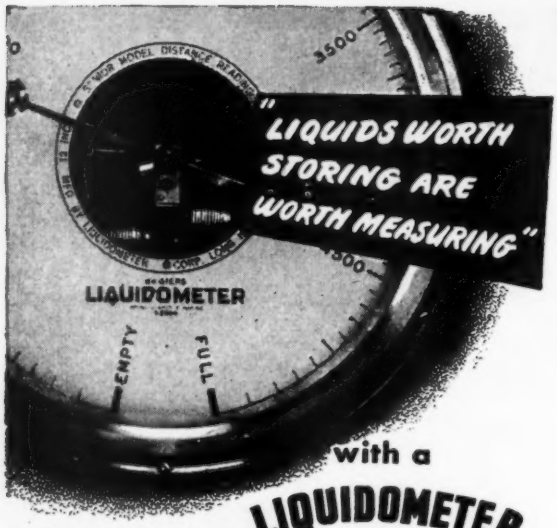

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- 100% AUTOMATIC
- APPROVED BY UNDERWRITERS' LABORATORIES

WRITE FOR COMPLETE DETAILS

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36-32 SKILLMAN AVE., LONG ISLAND CITY, N.Y.

winter after being used successfully last winter in many snow belt cities. One of its initiators, M. L. Davis, service director of the city of Akron, estimates that it is saving Akron motorists $250,000 per year.

Midwest Power Conference Hold Twelfth Annual Meeting

A three day meeting of the Midwest Power Conference will be held at the Sherman Hotel in Chicago on April 5, 6, and 7, 1950. Centered around the theme "Economy in Power", a total of 26 sessions including three luncheons and the all engineer's dinner are scheduled for the program. More than 50 papers will be presented by leading authorities in practically every phase of the power industry. The conference is sponsored by the Illinois Institute of Technology in cooperation with nine midwestern universities and nine local and national engineering societies.

Hotpoint's Expansion Program Nears Completion

The final phase in the Hotpoint Company's expansion program, which was commenced in 1947, is expected to be completed with the erection of a new refrigerator factory in Chicago within the next 15 months. All of the company's facilities for the manufacture of complete electric kitchens and home laundries, as well as its electric commercial cooking lines, will be centralized in the middle west with all products being produced in company-operated plants. At the same time all of the company's engineering will be consolidated in the main research laboratories in Chicago. As a pioneer in the promotion and sale of all-electric kitchens, Hotpoint is considered to be among the first companies to depart from the practice of making a single type

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Check today on your pumping equipment needs. Viking offers the most complete line in the rotary pump field. The range of sizes and styles are the largest available.

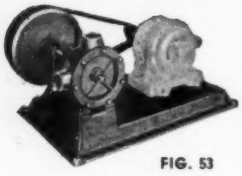
FIG. 53

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Spending too much TIME and MONEY operating your Zeolite Water Softeners or Sand Filters?

Getting erratic operation?

Then consider making them **AUTOMATIC** using the electrically operated **H & T POPPET** type multiport valves. They are "TOPS" for performance and **low in cost,** too.

Savings in labor, salt and improved operation may pay for the valves in as little as one year.

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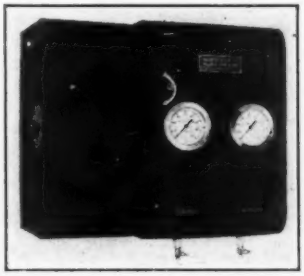

HUNGERFORD & TERRY, INC.
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Over 50 years experience—Over 5,000 installations

of appliance and then expanding its operations into manufacturing related lines. With the completion of the present plans, the company will be among the first in the nation to have reached the goal of centralized and company-operated manufacturing facilities for a full line.

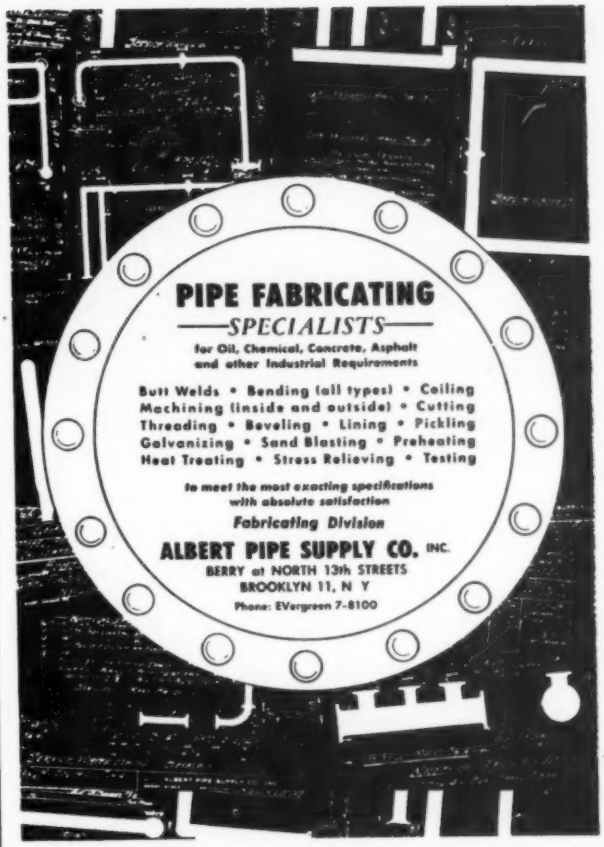
Explaining the broad growth in home use of electrical appliances, James J. Nance, president of the company, said that a greatly increased number of American homes have come to feel that electrical living is desirable. Aiding this has been an expansion of the nation's power output capacity with a majority of the electric utility companies increasing facilities to meet present and future demands, yet maintaining low service rates.

Defrosting the Iron Horse

At the Detroit & Mackinac Railway's diesel locomotive repair and maintenance shops, Tawas City, Michigan, four oil fired Dravo heaters are used to melt ice and snow off locomotive undercarriages. Air from the heaters is transported through ductwork to the repair pit, where it blasts the undercarriages and at the same time creates comfortable working temperature for the employes.

More Rubber Paving Forecast for Future

Increased utilization of rubber as a road building and recreational ground paving material is forecast for the next decade, according to P. W. Litchfield, chairman of the board of the Goodyear Tire & Rubber Company. He estimated that during the next 10 years, a yearly average of 650,000 miles of highways would be newly constructed or resurfaced, and that by installing rubber-asphalt surfacing material millions of dollars would be saved in highway and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MODEL HP
1 horsepower with 2-speed control.
MACHINERY
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PREVENT DAMAGE TO MACHINERY WITH THE . . .
Made in 5 models with attachments for every cleaning job.
PORTABLE COMBINATION BLOWER-SUCTION CLEANER
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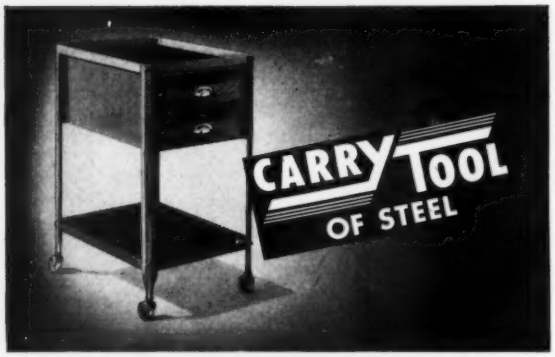

A NEW HALLOWELL TIME-SAVER

The sturdy, easy-rolling *CARRY-TOOL* is the handiest, time-saving "carrier" in the shop.

Made of heavy-gauge steel, the *CARRY-TOOL* has large drawers that hold a full complement of tools. *Ball-bearing* rollers make drawers slide *easily*, loaded or empty. Padlock attachments protect contents.

Use the *CARRY-TOOL* on assembly lines, at machines, in the tool room.

"*CARRY-TOOL* takes the tools to the job—therefore, a *step-saver.*"

Full details in Bulletin 715.

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Rich Iron Ore Deposit Discovered in Venezuela

Before the Joint Committee on the Economic Report, the United States Steel Corporation recently told the story of its important discovery in 1948 of an immense iron ore deposit in an unexplored region of Venezuela. Of higher iron content than that found in the Mesabi Range in Minnesota, this new deposit includes a mountain of ore called Cerro Bolivar. Reporting before the congressional committee, John G. Munson, vice president of United States Steel Corp. in charge of raw materials, stated that the discovery was made

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as a result of an active search for new sources of iron ore supply to augment the diminishing reserves in the Lake Superior region. Exploration parties traveling in planes, jeeps, and on foot carefully went over this terrain, and they eventually discovered the mountain of ore and other large deposits in the neighborhood. Rights for mining the properties were obtained from the Venezuelan government, and a large organization is now at work drilling and tunneling to determine the extent and character of the deposit, which is known to have an iron content in excess of 60%.

A subsidiary of the United States Steel Corporation, The Orinoco Mining Company, has been organized to undertake the development. Present problems include opening up of the country and developing means of transporting the ore from the interior of Venezuela to a shipping port on the coast.

Themocouple Tables To Be Revised in 1950

The National Bureau of Standards has an extensive project under way to revise all common thermocouple tables so as to keep abreast of the recent changes in electrical units and in the International Temperature Scale. Eight tables will be published during 1950, that include temperature-emf relations for platinum-platinum rhodium, chromel-alumel, and copper-constantan thermocouples.

In preparing the tables, emphasis will be placed on convenience and clearness. The explanatory text will be short, the numerals will be as large as practical, and the layout of pages and headings will be arranged to facilitate interpolation. Inverse tables, formerly lacking, will also be included. Each table, together with its inverse, will be issued as an NBS Miscellaneous Publication and will be available from

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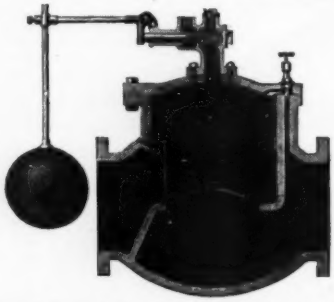

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2. Reference table for platinum vs platinum-10% rhodium thermocouples; emf at intervals of 10 microvolts vs degrees F; temperature at intervals of one degree F vs microvolts.

3. Reference table for platinum vs platinum-13% rhodium thermocouples; emf at intervals of 10 microvolts vs degrees C; temperature at intervals of one degree C vs microvolts.

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5. Reference table for chromel-alumel thermocouples; emf at intervals of 0.1 millivolt vs degrees C; temperature at intervals of one degree C vs millivolts.

6. Reference table for chromel-alumel thermocouples; emf at intervals of 0.1 millivolt vs degrees F; temperature at intervals of one degree F vs millivolts.

7. Reference table for copper-constantan thermocouples; emf at intervals of 0.1 millivolt vs degrees C; temperature at intervals of one degree C vs millivolts.

8. Reference table for copper-constantan thermocouples; emf at intervals of 0.1 millivolt vs degrees F; temperature at intervals of one degree F vs millivolts.

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85—(top) Worthington Pump & Machinery Corp.
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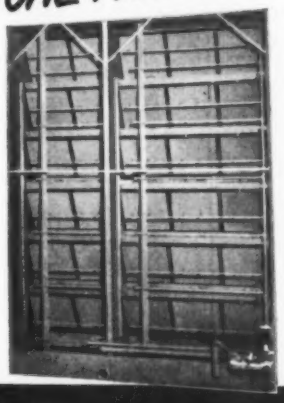

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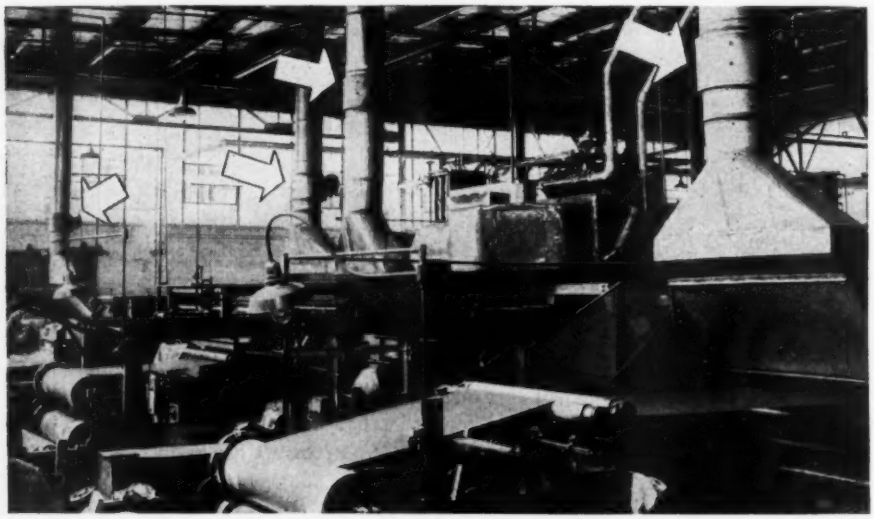

The photograph at the left shows Hartzell equipment installed at the Synthane Corporation, Oaks, Pennsylvania. Previous to the installation of Hartzell Belt-Drive Duct Fans, exhausting through the stacks shown, fumes and heat spread through the plant from the plastic coating machines in the photograph. The plant operator reports that both heat and fumes were completely eliminated by the installation, planned and specified by Hartzell.

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